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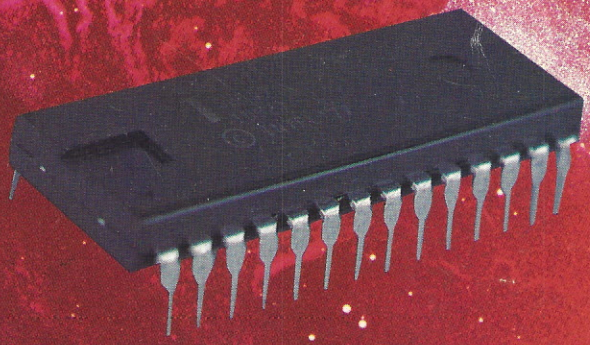

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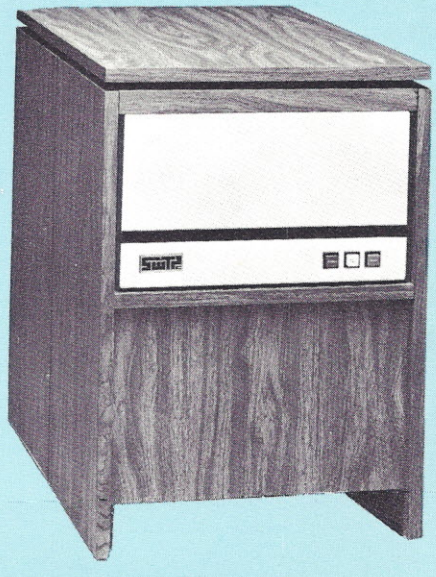

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CIRCLE INQUIRY NO. 85

Low-cost hard disk computers are here

11 megabytes of hard disk and 64 kilobytes of fast RAM in a Z80A computer for under $10K. Two floppy drives, too. Naturally, it's from Cromemco.

It's a reality. In Cromemco's new Model Z-2H you get all of the above and even more. With Cromemco you get it all.

In this new Model Z-2H you get not only a large-storage Winchester hard disk drive but also two floppy disk drives. In the hard disk drive you get unprecedented storage capacity at this price—11 megabytes unformatted.

You get speed—both in the 4 MHz Z80A microprocessor and in the fast 64K RAM which has a chip access time of only 150 nanoseconds. You get speed in the computer minimum instruction execution time of 1 microsecond. You get speed in the hard disk transfer rate of 5.6 megabits/sec.

EXPANDABILITY

You get expandability, too. The high-speed RAM can be expanded to 512 kilobytes if you wish.

And the computer has a full 12-slot card cage you can use for additional RAM and interface cards.

BROADEST SOFTWARE SUPPORT

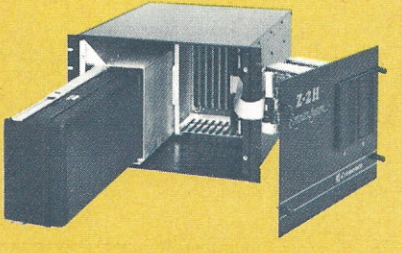
With the Z-2H you also get the broadest software support in the microcomputer field. Software Cromemco is known for. Software like this:

- **Extended BASIC**
- **FORTRAN IV**
- **RATFOR (RATional FORtran)**
- **COBOL**
- **Z80 Macro Assembler**
- **Word Processing System**
- **Data Base Management**

with more coming all the time.

SMALL, RUGGED, RELIABLE

With all its features the new Z-2H, including its hard disk drive, is still housed in just one small cabinet.



Hard disk drive at lower left can be interchanged just by sliding out and disconnecting plug. Seven free card slots are available. Z-2H includes printer interface card.

Included in that cabinet, too, is Cromemco ruggedness and reliability. Cromemco is time-proved. Our equipment is a survey winner for reliability. Of course, there's Cromemco's all-metal cabinet. Rugged, solid. And, there's the heavy-duty power supply (30A @ 8V, 15A @ +18 V, and 15A @ −18V) for circuitry you'll sooner or later want to plug into those free card slots.

CALL NOW

With its high performance and low price you KNOW this new Z-2H is going to be a smash. Look into it right now. Contact your Cromemco computer store and get our sales literature. Find out when you can see it. Many dealers will be showing the Z-2H soon—and you'll want to be there when they do.

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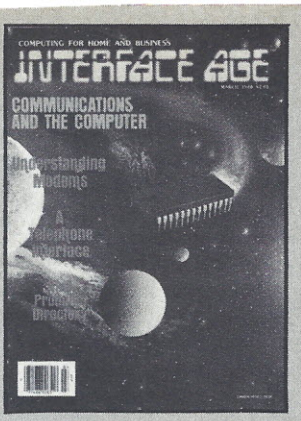
VOL. 5, ISSUE 3
SINCE DECEMBER 1975

MARCH 1980

INTERFACE AGE™

COMPUTING FOR HOME AND BUSINESS APPLICATIONS



THIS MONTH'S COVER

Design by Fino Ortiz, Art Director; background art by Ron Russell, (707) 996-1179; Intel chip supplied by Hamilton-Electro Sales, Culver City, California.

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Editorial Correspondence
Direct all correspondence to the appropriate editor at: INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, CA 90701

PRODUCTION
PRODUCTION MANAGER **DAVE ANDERSON**
PRODUCTION ASSISTANT **TERRI LEDESMA**
ART DIRECTOR **FINO ORTIZ**
ARTIST **SAMANTHA LEE**
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ADVERTISING
NEW ENGLAND REGION **DICK GREEN**
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INTERFACE AGE EUROPE
DIRECTOR, EUROPEAN OPERATIONS **H.L. GROHMANN**
Dahlienstr. 4, D-8011 Munchen-Vaterstetten, West Germany
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CIRCLE INQUIRY NO. 43

EDITOR'S NOTEBOOK

The winter Consumer Electronics Show in Las Vegas showed the continued growth of the microcomputer industry, with companies exhibiting their new products and impressive displays.

An estimated 55,000 attended CES, which was held January 4-8. Several new computer-oriented products were announced by the exhibitors, which demonstrated the growing acceptance of microprocessor technology by both the consumer product manufacturer and the end user.

HEWLETT PACKARD

Hewlett Packard made its long-awaited entry into the microcomputer field with the introduction of the HP-85. This unit features a keyboard, CRT, printer and tape all in one package.

The 34K BASIC in ROM provides users with a powerful version of BASIC which includes built-in, interactive graphics. The package, which HP says is a personal computer for the professional, will retail for about $3,200.

The HP-85 contains a five-inch, black-and-white CRT which can display up to 16 lines of data at a time, with each line containing up to 32 characters.

The small bidirectional thermal printer which operates in both alphanumeric and graphics modes, prints two 32-character lines per second. The magnetic tape reader uses HP's own magnetic tape cartridges.

The system is also equipped with four input/output ports which hold a variety of optional interface modules, giving it expanded capabilities in control applications and data acquisition.

The new unit is being manufactured and marketed by HP's Corvallis (Oregon) division, which also handles their line of calculators.

The system is now available at many dealerships across the country. Several new options are scheduled for the near future. These include a lineup of plotters, printers, disks and other peripherals.

NIXDORF

Nixdorf, a German-based computer manufacturer, made its first entry into the CES and featured the LK-3000. This handheld personal computer does calculating, translating, and a variety of other chores. The size of the unit belies its power. The computer, which features a small readout screen and a keyboard, is no larger than a pocket camera.

There are currently 11 bilingual modules, each containing more than 1,000 common words and phrases. Languages available for conversion to and from English are Spanish, French, Italian, Greek, German, Polish, Portuguese, Swedish, Russian and Japanese.

Three different interface modules are also available for the LK-3000 to be used as a dialogue terminal. They are modules with EIA-RS232 C standard interface and a 20 mA current loop interface which allows direct connection to output devices. The third module is a parallel interface used as an input/output device for computer systems.

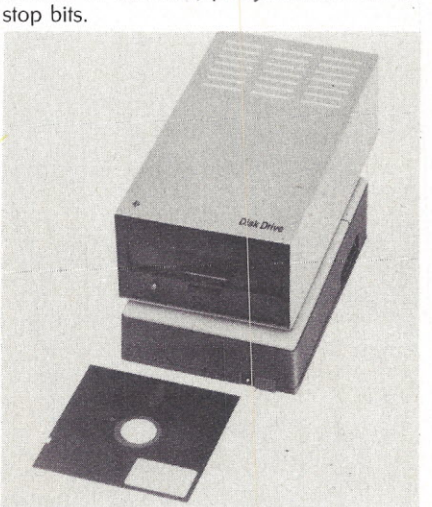
The LK-3000 can also be programmed as an electronic notebook which retains all stored information. With the electronic notebook, the user can carry in his pocket a computerized listing of phone numbers, birthdays, appointments or even a shopping list. A filing module makes the LK-3000 the first handheld computer which allows records to be accessed quickly without using a central computer terminal.

By simply plugging in various modules, the user can convert the LK-3000 from a language translator to a calculator to an electronic notebook. This 10.6-ounce computer operates on built-in rechargeable batteries or from a standard plug-in.

TEXAS INSTRUMENTS

Texas Instruments used the winter CES show to announce upgrades for the home computer system which was introduced at the summer CES in mid-1979. The Dallas firm added five new peripherals to its line of products for the model 99/4.

Included in the new additions is an RS-232 interface with two serial ports. The RS-232 provides software selectable baud rate, number of data bits, parity and number of stop bits.



A minifloppy disk system with up to three disk memory drives is another feature TI added to their 99/4. The system can store up to 90,000 bytes of information on each floppy diskette. Provided also is a Solid State Software command module with utilities including disk and file maintenance.

A 300-baud acoustic modem is the third addition to the 99/4 which allows the

system to communicate over a telephone line with other computers. The modem has originate and answer modes which are connected through the RS-232 interface.

Another interesting new feature is a speech module that uses the same voice synthesis technique as TI's popular Speak and Spell toy. This speech module for the 99/4 has a capacity for slightly over 300 words. Other modules with up to 800 additional words can be interfaced to the system, giving the user a vocabulary of well over 1,000 words. This entire vocabulary is accessible and usable from BASIC.

The fifth new peripheral is a thermal printer which uses two predefined character sets, along with graphic circles for printing text, charts and graphs. This device is also accessible from BASIC. The printer uses the same 3½-inch thermal sensitive paper that is used in TI's commercial calculators. The printer prints 32 columns of 5x7 dot matrix characters at 30 characters per second.

The entire group of new peripherals, including three disk drives, sells for just under $3,000.

ELECTRONIC MAIL

Since we began investigating The Source for the article published in January, we have become quite involved in it. Because of our increased involvement with the electronic mail system, we have decided to postpone the software article originally scheduled for this month. We are now preparing a fully developed program to be printed early in the summer.

At this time INTERFACE AGE has become the first magazine to provide basic electronic mail services. TI, Apple, Commodore and others also used The Source in their displays at the show.

Visitors at our booth at CES got a taste of what can be done with The Source. At the user's discretion, electronic mail systems can be used to get information about wines, income tax preparation, BASIC programs, prices of several types of items, and a host of other topics. Most who saw a demonstration of the power and diversity of applications for The Source were quite impressed with the potential of the system for their own use.

If you are a subscriber to The Source, drop a few bits at TCD073 and let us know what uses you've developed for The Source. Or if you are interested but not yet a member, or belong to another electronic mail system, write to P.O. Box 1234, Cerritos, CA 90701 and let us know what you'd like to do with electronic mail. We are increasing our involvement in electronic mail and expanding into some of the other networks now available.

PASCAL NOTEBOOK

Due to some problems with overloaded mailmen at our March deadline during the holiday season, we were not able to publish the final chapter of The Pascal Notebook this month. Therefore, it will be printed in the April issue. Henry will be providing some tables to sum up his tutorial, along with a brief listing of some books and companies that will be of interest to those who are interested in Pascal.

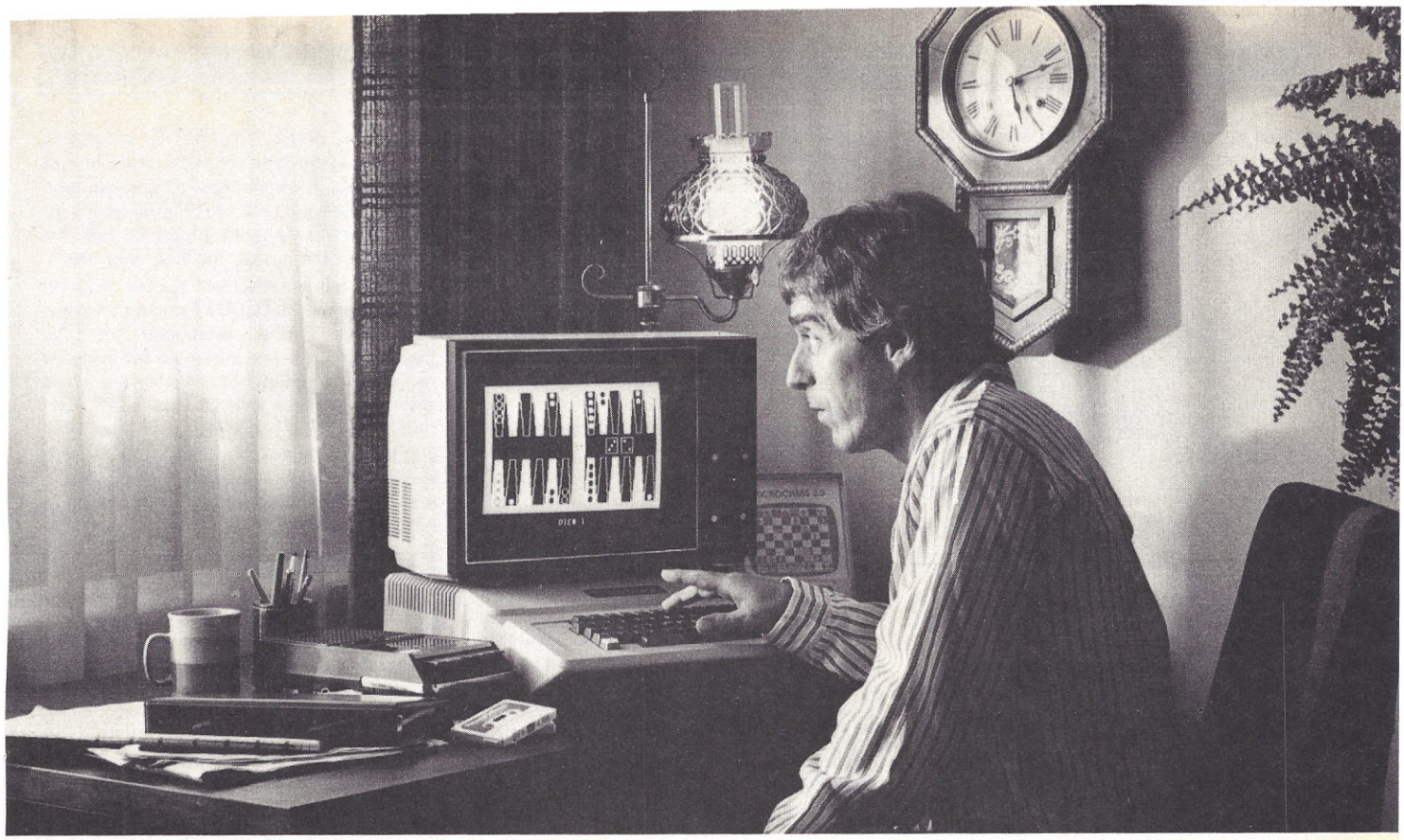
Response to the listings mentioned in January has been quite overwhelming, so please be patient as we may be a little delayed in sending out the information. But it will be coming soon.□

An Artist's View of the Universe

"Neutron Star"

Man perceives the Universe on many levels: beyond scientifi limits the spirit reaches for more meaning, more feeling, mor beauty. Now, through the brilliant work of Ron Russell, we hav an exciting emotional and visual interpretation. It has taken si years for Russell to develop the process of Glass Art, using a aerospace technology that gives remarkable clarity and depth The result is a unique and critically acclaimed series of painting and prints which capture the very essence and splendor of ou Universe.

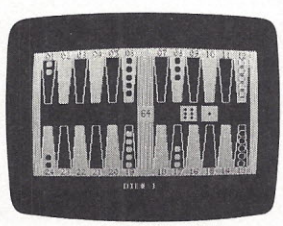
Limited edition collector's prints now available. Now INTERFACE AGE readers have an opportunity to acquire limited edition prints of Ron Russell's most famous works. Each print is numbered documented and signed by the artist and will make a handsome addition to any collection.



Even at 5:12 a.m., it's hard to quit playing Personal Software™ strategy games.

A quick game before turning in can become an all-night session when you load any of the Personal Software™ strategy games into your Apple,* PET* or TRS-80.* They'll challenge, teach and entertain you. And now there are two new games—Gammon Gambler™ and Checker King™—joining Bridge Partner,™ Time Trek™ and the best-selling Microchess.™

Gammon Gambler is a sure bet. With ten levels of skill, you can begin a novice and become an expert. Whichever level you play, the computer moves so quickly you don't have to wait. The program follows U.S. tournament rules, and includes the doubling cube to spice up the game. Written for the Apple and PET by Willy Chaplin. $19.95.

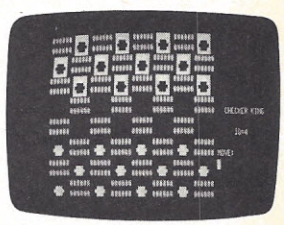


Gammon Gambler

Checker King—you probably forgot how much fun it is! If you move and

Bridge Partner. You against the computer in over 10 million different hands of contract bridge. You can even specify the hands' high card points. Written by George Duisman for the Apple, PET and Level II TRS-80. $19.95.

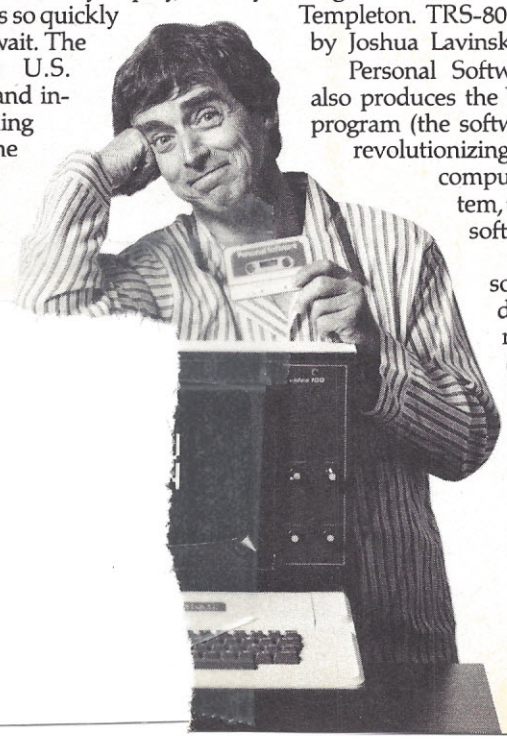
Time Trek is easy to learn, difficult to master and impossible to forget. Take command of a starship in real-time action to make the galaxy safe again. PET version by Brad Templeton. TRS-80 program by Joshua Lavinsky. $19.95.



Checker King

Personal Software, Inc., also produces the VisiCalc™ program (the software that's revolutionizing personal computing), CCA Data Management System, the Vitafacts series and other exciting software for the Apple, PET and TRS-80.

Now that you've read about the Personal Software programs, go see a demonstration. For the name of your nearest Personal Software dealer, call (408) 745-7841 or write to Personal Software, Inc., 592 Weddell Drive., Sunnyvale, CA 94086.



PERSONAL SOFTWARE

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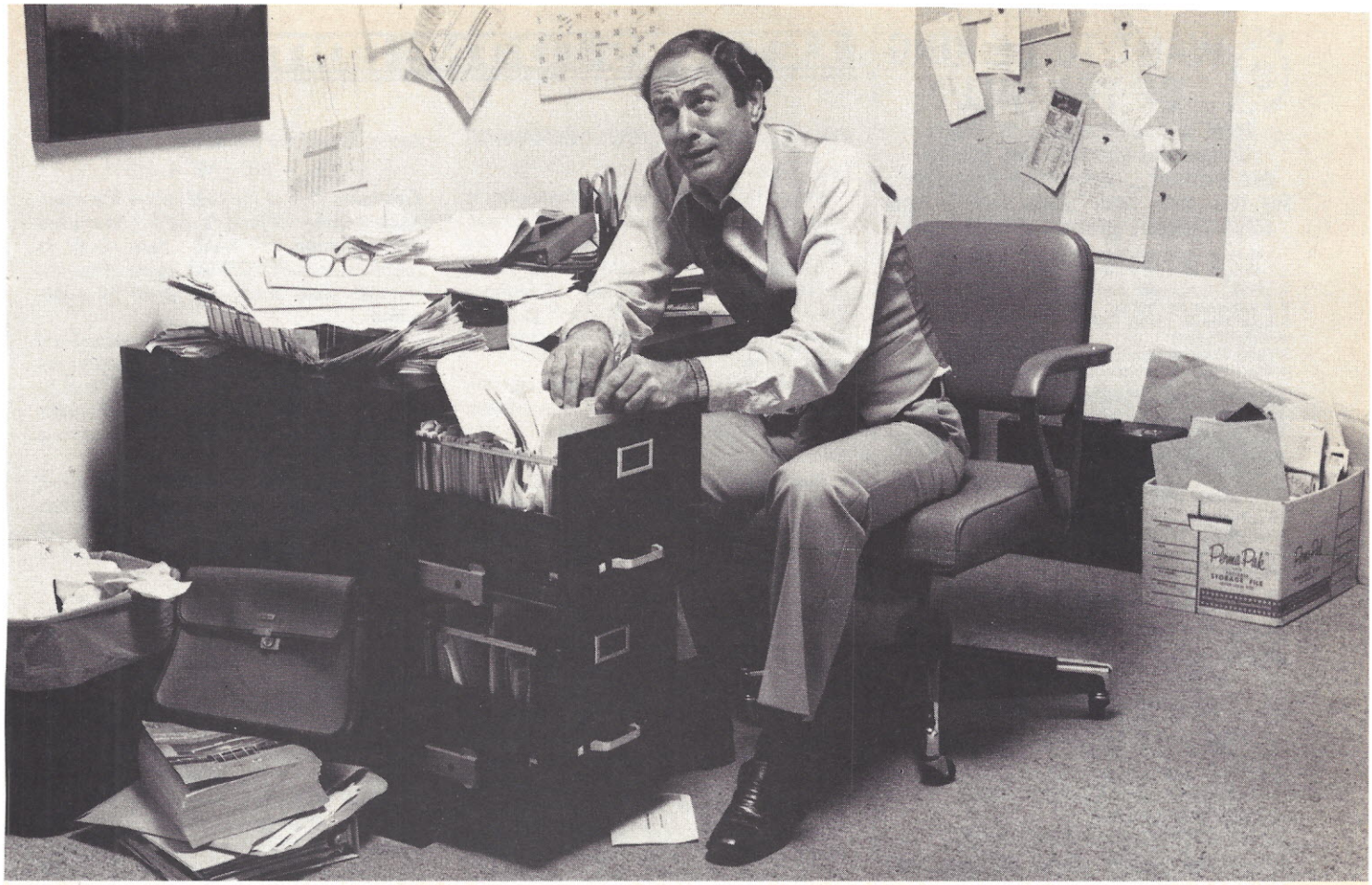
STRATEGY GAMES SERIES



Record keeping problems? Our CCA Data Management System solves them easily.

Having information at your fingertips can make your job a whole lot easier. And that's what the CCA Data Management System is all about.

With this Personal Software™ package and an Apple II™ or TRS-80™ disk system, it will be far easier to keep inventories, customer lists, accounts receivable and payable records, patient histories and many more items.

In fact, you can use the CCA DMS for all of your data management needs, rather than buying (expensive) or writing (time consuming) separate programs for each application. That's because DMS lets you create your own filing systems, adapting itself to the types of records you keep. You specify the number and names of each data field—without any programming.

With DMS keeping all of your records, you only have to learn how to use one system. That's easier, too. It's menu driven, with plenty of prompts to help you create files and add, update, scan, inspect, delete, sort, condense and print data. Our comprehensive 130-page step-by-step instruction manual even provides complete "how to" inventory and mailing list applications so you can start processing immediately.

DMS is a very powerful system, with more file and record storage capacity than other data base programs on the market.

And it also gives you greater data handling flexibility. To customize DMS, write add-on BASIC programs that read or write DMS files and perform any kind of processing you want.

You can sort and print your data in nearly any form of report and mailing label you want. Sort data by up to 10 fields for zip code, balance due, geographic location or whatever. And print reports with subtotals and totals automatically calculated.

The CCA Data Management System, written by Creative Computer Applications, has two years of field testing on other microcomputers. Now Personal Software makes DMS available on the TRS-80 Level II and Apple II and II Plus 48k disk systems. And at under $100, DMS is also easy to afford.

One demonstration will convince you how easy computerized record keeping is. Ask your Personal Software dealer to show you. To locate your nearest dealer, contact Personal Software, Inc., (408) 745-7841, 592 Weddell Dr., Sunnyvale, CA 94086.

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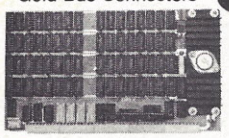

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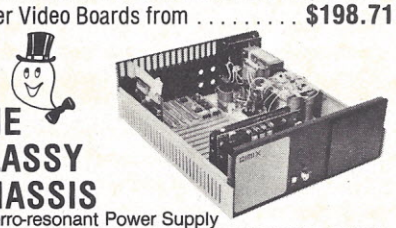

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CIRCLE INQUIRY NO. 41

LETTERS TO THE EDITOR

ON ALAN MILLER AND SOFTWARE

Dear Editor:

I found INTERFACE AGE Software Editor Alan Miller's comments in the October, 1979 issue to be of great importance ('Miller Speaks' in the Letters to the Editor, p. 16). His software article "Announce Your Next Meeting with Posters" (p. 139) clearly raises equally important questions about his level of expertise.

It is quite obvious that a number of computer magazines do not test the software they receive from hopeful authors. His dot-matrix listing will not run as listed. Starting in line 1310 the number of missing quote marks in the DATA statements is rather hard to accept. I count 176 missing quote marks out of a total of 1652 (over 10%). This listing cannot be a final copy; the missing quotes give me READ and SYNTAX ERROR messages on my North Star Horizon. Also, putting four instead of five strings on the first line of some of these statements (A, B, P, etc.) makes them much harder to read.

As for sloppy and inefficient programming, I would much rather have simple-minded methods that work rather than super fancy ones I cannot figure out because they are incorrectly programmed. I spend a lot of time converting Altair-type strings to work on my North Star. If I have to re-invent parts of the coding to get it to work on my system, then it takes me even longer to get some similar version of an author's program to work. Exact duplicates of a program are hard to come by when authors do not specify all of the special codes they used. All too often they assume that everyone has the same hardware and system software when the truth is that no such thing exists.

Dr. Miller allows you to enter nine lines of large characters and 15 lines of small characters. If you enter the full complement, you will get an empty box. Lines 410 and 540 will correctly set the number of each type of line entry if you use less than the maximum number of each type. If you enter the maximum number of lines, you do not get the number of lines at all and they are then equal to zero. To fix this add an extra statement on the ends of lines 350 and 500: NL = I and NS = I, respectively. The author never checked the operation of the maximum number of lines; a rather common occurrence.

I bought that issue mainly for this program, but the thought of having to enter his horribly messy matrix table almost made me forget it. That table is easily the longest one in any of the six poster programs that I have right now. It was easier to make up than the other types of tables used elsewhere, but I claim that it shows poor programming practice, is difficult to enter, and is definitely simple-minded in a way I do not like (the opposite of what he says he wants).

Saul G. Levy
Tucson, AZ

Dear Mr. Levy:

Thank you for calling my attention to an error in my Poster program. A simple solution is to add the following to line 200:

NL = ML : NS = MS

This takes care of the case where the maximum number of lines is used. I have used this program for many years, both in BASIC and in FORTRAN. Some of the last changes were made just prior to publication.

The other items you mention are caused by your dialect of BASIC. My version runs on Microsoft and Xitan disk BASIC and on our DEC 20 BASIC. (Although in the latter case the colons have to be changed to a backslash.)

Get a copy of Microsoft BASIC and you'll never go back to your old BASIC. Strings needn't be in quotes unless there are leading or trailing blanks, or punctuation present.

Alan R. Miller
Software Editor

Dear Editor:

I would like to note a few errors in the article about SP80 entitled "Structured Assembly Programming for the 8080" by Dr. Alan Miller in the November 1979 issue of INTERFACE AGE. First, Dr. Miller states incorrectly that the IFTHEN. . .ELSEDO construct of SP80 is inherent in the Digital Research macro assembler. The IF. . .ELSE capability provided in the Digital Research assembler merely provides conditional assembly capability. In contrast, the relations in the SP80 IFTHEN statement are evaluated when the program is executed. The distinction is analogous to the difference between a subroutine and a macro. The second minor error is that the IFTHEN . . .ELSEDO construct is described as a loop construct. IFTHEN. . .ELSEDO is a conditional not a repetitive construct.

In addition, I would like to mention a few salient features of SP80 which were not mentioned in the article. SP80 will generate 8080 or Z-80 code for all the more complex relations (greater, less, greater or equal, less or equal) as well as permitting the use of AND and OR to combine relations. Also, structures can be nested to six or more levels, e.g. IFTHEN embedded within a LOOP.

I think that the article was outstanding in that it clearly indicated the role of SP80 with respect to other "languages."

Bob Slaski
Author of SP80
Reston, VA

Bob Slaski is correct. The IF. . .ELSE is an assembler directive which does not directly generate code, whereas the SP80 construction IFTHEN. . .ELSEDO does. The analogy of comparing a macro to a subroutine is perfect.

Alan Miller

Dear Editor:

A comment on the article "APL for the Z-80 Vanguard CP/M Version" by Alan Miller (October 1979). The article is a well

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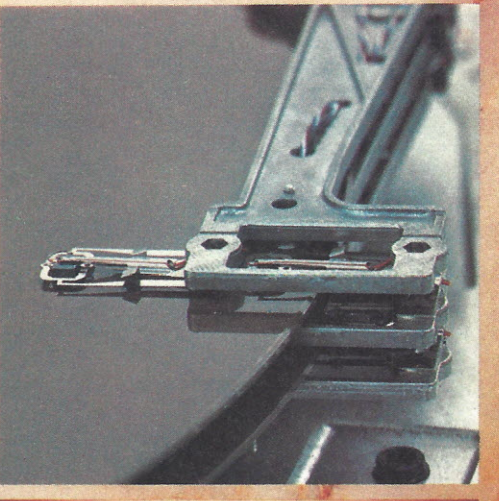

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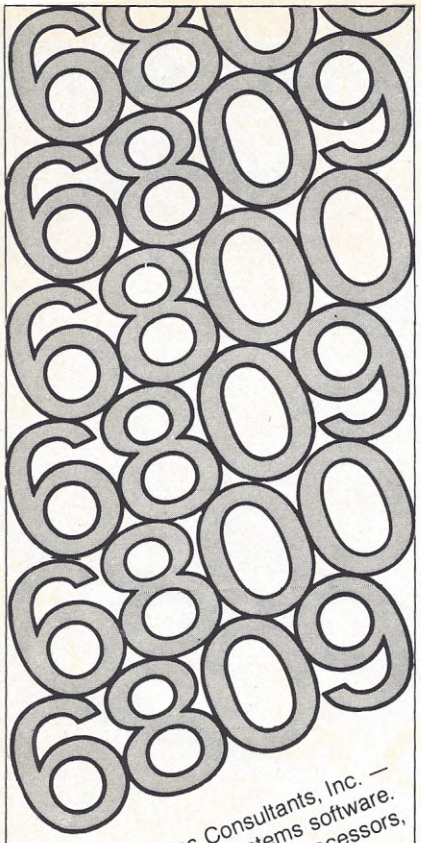

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CIRCLE INQUIRY NO. 95

written description of the APL language. Most of the information in it though could have been gleaned from the reference book by Gilman & Rose.

What I would have liked to see, however, is a critical examination of the specifics of this particular implementation of APL, i.e. the Vanguard CP/M version. Here are some examples:

1. What memory is required for the interpreter and therefore what is left for the user work area?
2. What are the performance aspects of the interpreter? That it is faster than a DEC-20 is meaningless for somebody not knowing anything about it.
3. What does a program look like using the ASCII character set? How about a sample, side by side with the APL character set?
4. How does the interpreter interface with CP/M? Can the programs be edited with ED? Where in memory does it reside in relation to CP/M modules?

In general, the idea is that an article written by your software editor should have more content than what can be gleaned by reading the user manual. This article is just barely passing the mark in this respect.

Jake Ever
Johannesburg, South Africa

The APL review included fundamentals on the APL language in the hope that readers would be induced to try it. APL is large; it takes up 32K bytes by itself. A 44K byte system would be large enough to handle it. APL programs are saved in binary form and so cannot be edited with ED.

Alan Miller

NEGATIVE ON NUCLEAR

Dear Editor:

I am writing in reference to Carl Warren's column "No Nuke Is Not Good Nuke" in the Editor's Notebook of the January issue. The comments were inaccurate, offensive, and totally out of place in your magazine.

As for "anti-nuclear people flapping off their mouths about something they really don't know anything about," it is very difficult to know anything about nuclear issues because we have a government that censors nuclear articles and labels them "top secret." The implication is a dangerous one: only the government is wise enough to evaluate nuclear issues; the ordinary citizen is denied any information that would be necessary for him/her to make any intelligent decisions about nuclear energy.

As for "so-called leaders and celebrities," such inappropriate slander only shows your right-wing armbands.

As for "after contamination," what about the genes of our future generations? The destruction of millions of people, present and future, is the potential (and after Three Mile Island, probable) cost of our continued reliance on nuclear energy. Are you really willing to pay that?

Will Nelson
Cupertino, CA

Dear Editor:

In your eagerness to criticize those who oppose nuclear power you overlook several important points. First of all, haven't you read Amory Lovins? Your remark that alternatives to nuclear power are lacking would indicate that you haven't. Aren't you aware that nuclear power plants are no longer economically attractive, that many are being cancelled, that the huge capital investment involved in building a nuclear power plant is essentially temporary since these plants have a lifetime measured in decades, before they are too radioactive for further use?

Nuclear power is the most selfish program our extremely selfish age has yet to undertake; first we used up all the fossil fuels, which could have provided petrochemical products for centuries into the future. We have spread lead and PCB all over the earth. Now we are about to leave, as our heritage to the people of the future, millions of barrels of radioactive waste, burned out nuclear plants dotting the planet like mausoleums, and genetic damage which will last forever, to our eternal shame, and you are one of the individuals who has chosen to lead us in this path.

E. Searcy
Santa Barbara, CA

LOOKING FOR HELP

Dear Editor:

I'd like contact with anyone who has determined the nature of the incompatibility between the Cromemco ZPU board and the Imsai VIO-C video interface board — when both are installed in an Imsai I-8080 mainframe.

Also, I'm trying to locate a firm or a person who really knows how to repair an Imsai DIO disk interface board.

Jack Williams
902 Anderson Drive
Fredericksburg, VA 22401

Dear Editor:

I want to get training as a computer programmer and systems analyst and am looking for companies I could work for and get training from them. (I am a former high school teacher of mathematics and physics and 30 years old.)

Do you know any such companies in the U.S.? If you could find out something for me I would be very grateful to you.

Reimer Burkner
GaBnerstr. 20, 8000 Munchen 19
West Germany

IMPRESSED WITH SERVICE

Dear Editor:

Rarely does anyone mention the good guys, only the bad ones. I have dealt with several computer stores and visited many others in the U.S.A. and Canada, but never have I been as impressed as I am with the Computer Mart of New Jersey, 501 Route 27, Iselin, NJ.

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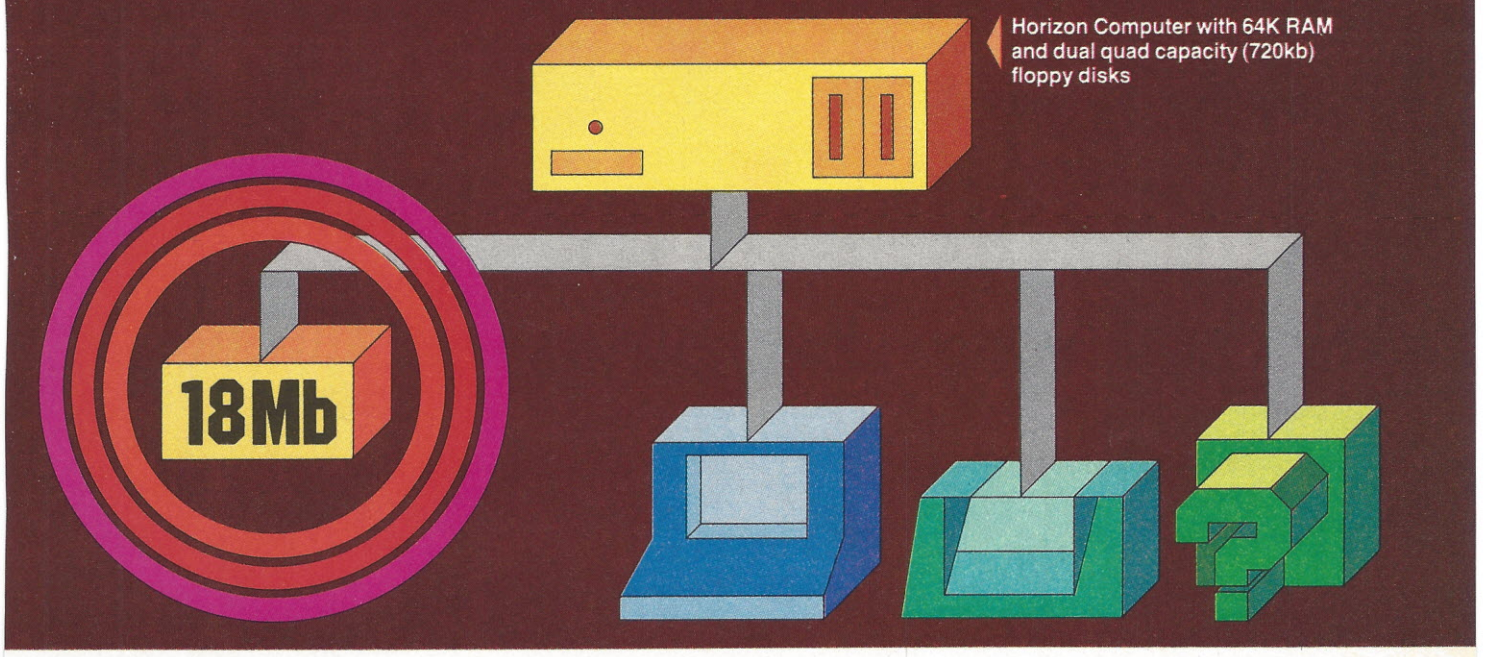

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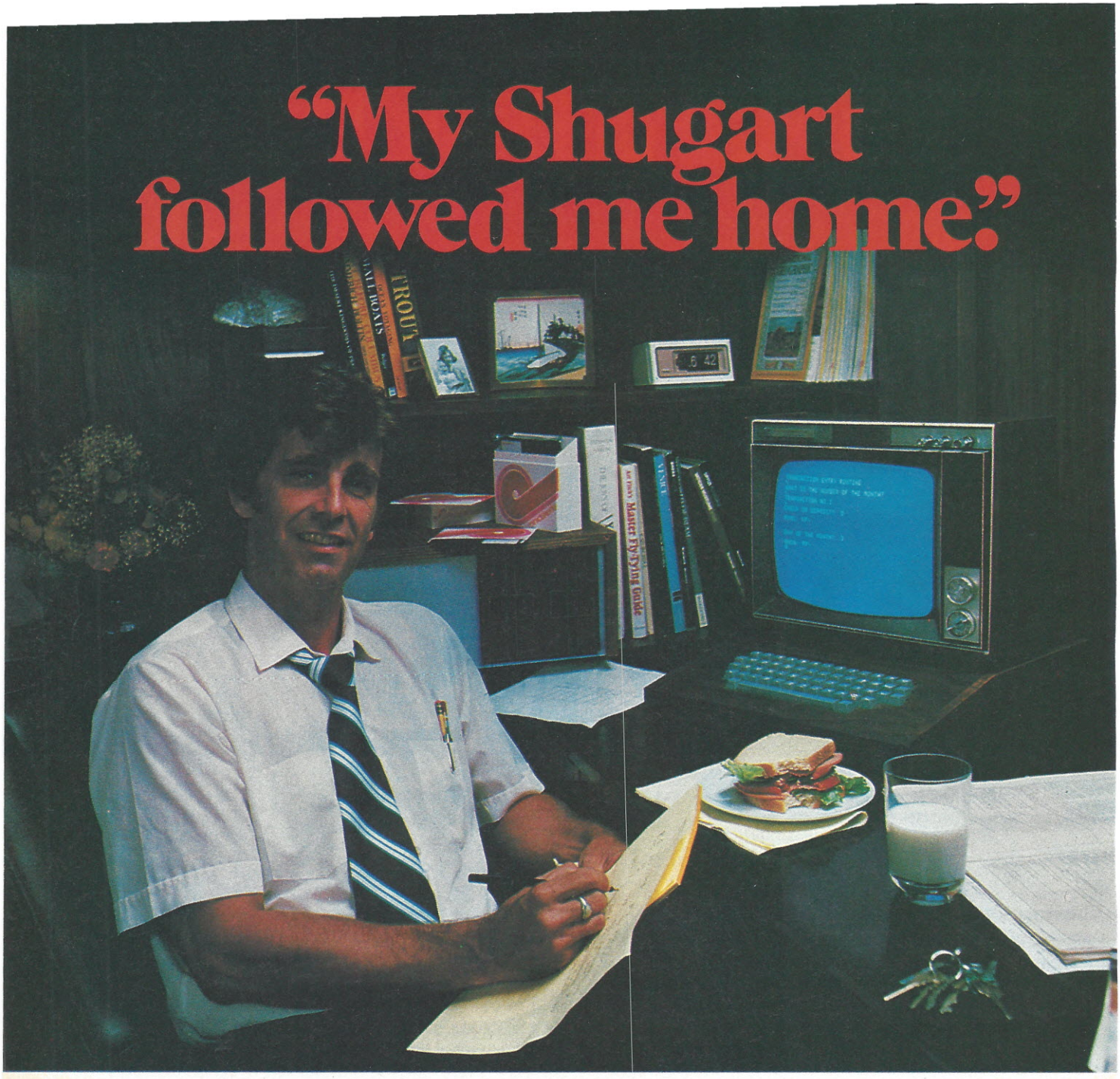

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have immediately assisted me with information of a technical nature and with service where required to solve these problems.

In several instances, I called on the phone and they promptly helped and at no mention of charge. They are a very knowledgeable group who support what they sell and I feel others should know where the better dealers are and Computer Mart of NJ is in my opinion one of the best, if not the best.

L.H. Kunin
Montreal, Quebec, Canada

QUERYING THE SOURCE

Dear Editor:

I was certainly intrigued by your article on The Source in January, 1980, but I sure got cooled off when I found one of your statements was exaggerated to the point of being ridiculous. This statement at the bottom of the first column says, "by dialing a local phone number from virtually any point in the United States."

In examining this statement I find that from virtually any point in Florida, the local call does not work except in about three localities and in virtually all points in Florida the charges would be about $14 per hour, and this would be on the cheap evening rate.

I think it only fair to inform your readers that your enthusiasm ran away with your judgement and the charges would be much more than the $2.75 quoted.

George Haller
Naples, FL

According to representatives of The Source, the statement in the article is correct. Charges would remain at the $2.75 rate for evening and early morning calls.

In outlying cities that do not have direct phone connection with The Source, however, users would have to pay long distance rates to call the nearest of 300 U.S. cities that have the direct connection. This rate is charged by the phone company, not by The Source. For further information about the service phone (800) 336-3330.

— editor

COMMENTS ON MORTGAGES

Dear Editor:

Dr. Adler's MORTPAY program in his August 1979 column prompts me to raise two points concerning loan and mortgage calculations.

1. Outside the U.S.A., mortgages do not usually follow all the conventions embodied in the discussion and body of MORTPAY. In the United Kingdom, most mortgages are demand loans and are recomputed when interest rates shift. Here in Canada the Interest Act requires that the effective monthly rate be equivalent to semi-annual compounding. If T=12 (12 payments per year), the rate per period (month) R1 is then found by equating

   $$(1 + R1)^6 = (1 + R/200)$$

   where R is the nominal rate per year in percent. That is, the effective monthly rate compounded over six months must give the same amount as simple interest over the same period at the nominal rate. MORTPAY can be modified to reflect this condition by changing statement 94 to read

   94 R1 = (1 + R/200) @ (1/6) — 1

   T must be entered as 12 in this case.
2. The short precision chosen for many BASIC systems — often only 6 digits — means that rounding errors will not permit MORTPAY to give results correct to the nearest penny for many sets of inputs. The use of the exponentiation operator (@), with attendant approximations to logarithms or similar functions, will accentuate this difficulty. While it is relatively straightforward to devise codes using higher precision arithmetic, programs which guarantee that the results are correct to the nearest penny require a great deal of effort to prepare, especially in the context described above for Canada where fractional powers may be required.

Dr. John Nash
Vanier, Ontario, Canada

QUESTION ON HEX29

Dear Editor:

I feel that a comment is in order regarding Tom Fox's article in the January issue on the HEX29. On page 94 is a table of times for a benchmark program computing prime numbers to 1000. Having just computed those prime numbers in 150 seconds on my TRS-80, I must conclude that either the table is a total misprint or that the benchmark program was somehow concocted in such a way as to take as much time as possible. (Although I do happen to know some very fast algorithms, my program was the simplistic "divide-by everything in sight" approach, since that was what I assumed was used.)

I do not wish to cavil over algorithms, but I would like to point out that, if the times are correct in the table, the algorithm *must* be the simple division algorithm. And thus the benchmark program is not really testing the HEX29, but only its division step (the primes under 1000 can be computed using my program with about 21000 divisions). I hardly feel that such a program adequately shows the computing power of any machine, however impressive the table statistics are.

Dr. Duncan A. Buell
Dept. of Computer Science
Louisiana State University
Baton Rouge, LA

You are correct, the algorithm is a simple division algorithm. Benchmark programs are selected to test the speed of a computer in doing repetitive operations. They are generally chosen for their ease of adaptation for operation on several machines.

In May, Tom Fox will discuss benchmark programs such as the one supplied by the manufacturer for the January article.

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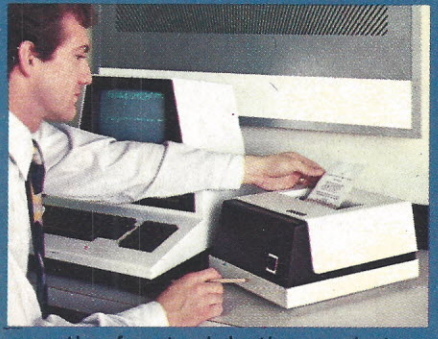

growth of a stock in the market, or any of the other thousands of analytical functions your computer can perform, a quality printer is simply invaluable. But you'll want to be sure to pick the right printer for your system.

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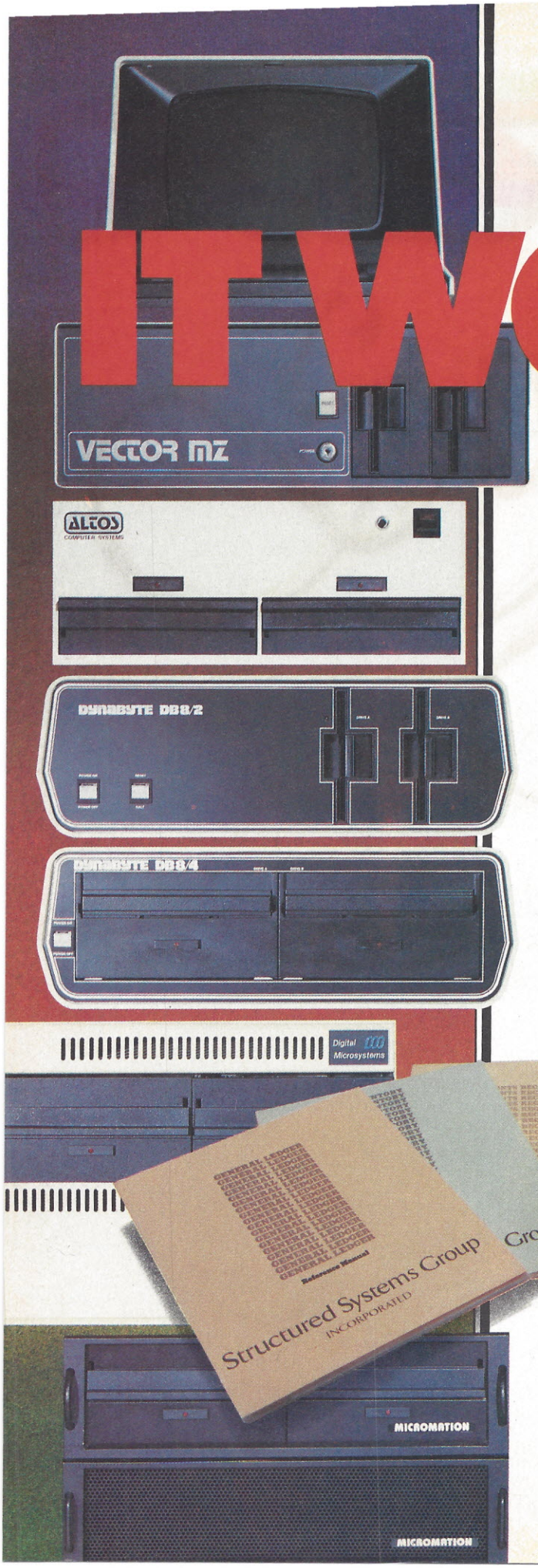

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There's only one logical way to find out what a person wants in a personal computer.

Ask the person who'll be using one.

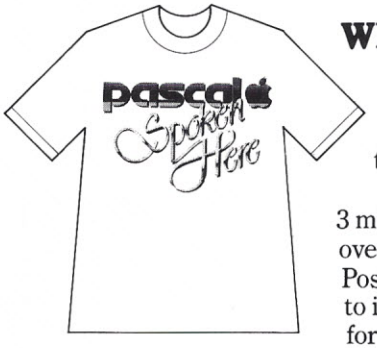
At Apple, we've been very successful at identifying just what people look for in computers. And then providing them with it.

In spades.

For serious enthusiasts, this means making available sophisticated innovations that are often conspicuously absent from other personal computers.

Like Pascal.

Apple II is one of the few personal computers that has it. And when you turn this page and feast your eyes on the many advantages this high level, general-purpose language has to offer, you'll see why that's very good news indeed.



When you've got it, flaunt it.

If you'd like to let the world know who speaks Pascal, here's how:

Follow the dotted line and cut out the transfer image above.

Preheat iron (dry-wool setting) for 3 minutes. Slip garment on ironing board over scrap material. Remove wrinkles. Position transfer face down and pin edges to ironing board cover. Iron transfer slowly for one minute. If paper browns, iron is too hot. Let transfer cool for one minute, then unpin and slowly pull transfer straight up. Results are best when t-shirt is at least 50% polyester.

Pascal by the package.

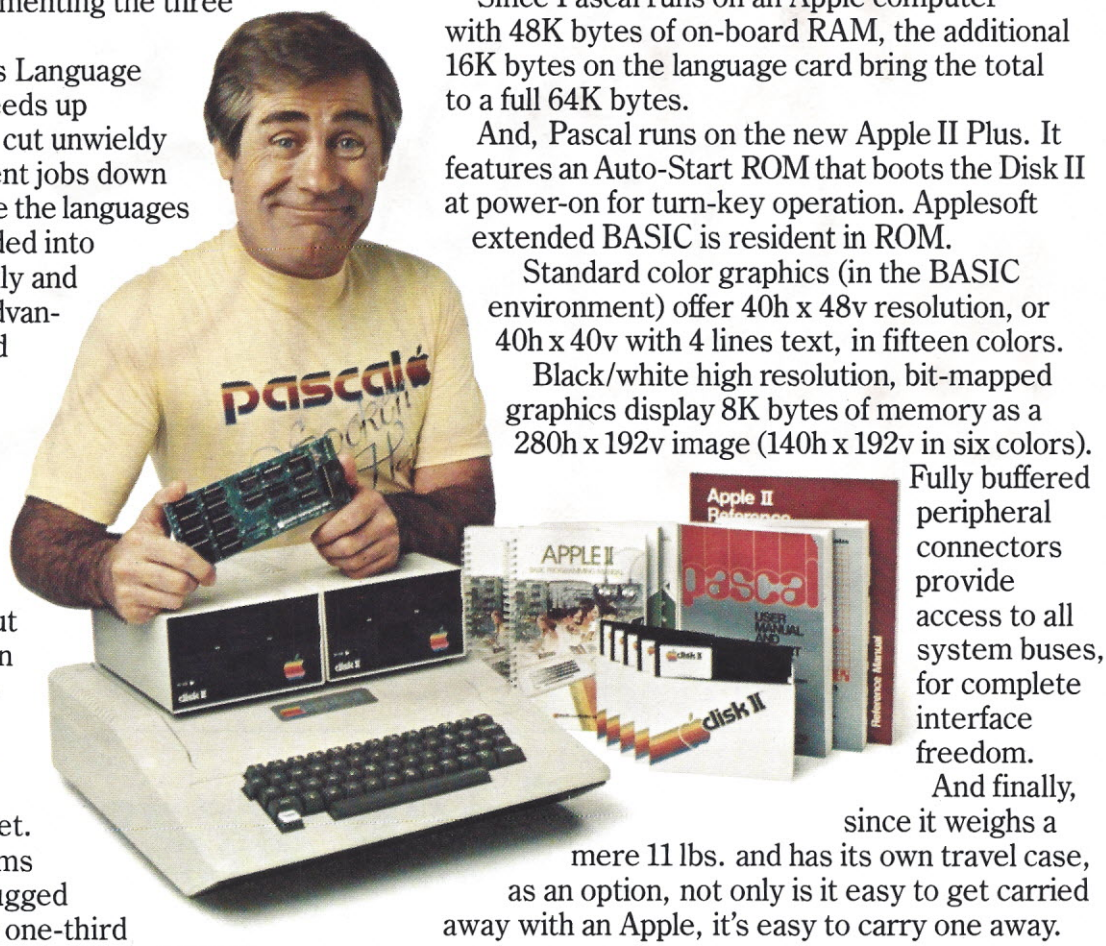
Our high-level, full feature Language System consists of a plug-in 16K RAM language card, five diskettes containing Pascal as well as Integer BASIC and Applesoft extended BASIC, plus seven manuals documenting the three languages.

The beauty of this Language System is that it speeds up execution and helps cut unwieldy software development jobs down to size. Also, because the languages are on diskette, loaded into RAM, you can quickly and economically take advantage of upgrades and new languages as they're introduced.

Apple's Pascal language takes full advantage of Apple high resolution and color graphics, analog input and sound generation capabilities. It turns the Apple into the lowest priced, highest powered Pascal system on the market. With Pascal, programs can be written, debugged and executed in just one-third the time required for equivalent BASIC programs. With just one-third the memory.

On top of that, Pascal is easy to understand, elegant and able to handle advanced applications. It allows one programmer to pick up where another left off with minimal chance of foul up.

Because Apple uses UCSD Pascal,™ you get a complete software system: Editor, Assembler, Compiler, and File Handler. And because we adhere to the standard, your programs run on any UCSD Pascal system with minimum conversion. Which is really something an enthusiast can get enthusiastic about.



To be more specific.

The Apple II's specs are tempting enough without the Language System and Pascal. With them, they're downright irresistible.

The text screen, a 24x40-line window, can display an entire 80-column Pascal line, thanks to Apple's unique horizontal scrolling feature.

Characters are normal, inverse or flashing, 5x7, upper case. Full cursor control is standard.

Since Pascal runs on an Apple computer with 48K bytes of on-board RAM, the additional 16K bytes on the language card bring the total to a full 64K bytes.

And, Pascal runs on the new Apple II Plus. It features an Auto-Start ROM that boots the Disk II at power-on for turn-key operation. Applesoft extended BASIC is resident in ROM.

Standard color graphics (in the BASIC environment) offer 40h x 48v resolution, or 40h x 40v with 4 lines text, in fifteen colors.

Black/white high resolution, bit-mapped graphics display 8K bytes of memory as a 280h x 192v image (140h x 192v in six colors).

Fully buffered peripheral connectors provide access to all system buses, for complete interface freedom.

And finally, since it weighs a mere 11 lbs. and has its own travel case, as an option, not only is it easy to get carried away with an Apple, it's easy to carry one away.

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800-538-9696. (In California, 800-662-9238.) Or write us at 10260 Bandley Drive, Cupertino, California 95014. When you contact us, we'll give you the name, address and telephone number of the Apple computer dealer nearest you.

If you'd like more information on the advantages of owning an Apple personal computer, he can fill you in. Personally.

apple® computer

UPDATE

TELECOMMUNICATIONS & EDUCATION FOR THE DEAF

The Amateur Radio Research and Development Corporation (AMRAD) — an amateur radio and personal computing club with headquarters in the Washington, DC area — has been awarded a federal grant for research in applying personal computers to telecommunications and education for the deaf. The grant is administered by the Bureau of Education for the Handicapped, U.S. Office Of Education, Department of Health, Education and Welfare.

The program involves interfacing home computers such as the TRS-80 and Apple II for both ASCII and Baudot telephone-line communications. The Baudot capability is needed to equip the computer to communicate with Baudot teleprinters (TTYs) which are in widespread use by the deaf. The hardware, software and protocols developed under this program will be released to industry for commercial production. When these products become available, the deaf will be able to communicate with others as well as make normal use of a computer in the home.

Also, a computer information exchange will be established. It will be used for informal communications between those involved in education of the handicapped.

In addition, it will have an extensive database which can be accessed by remote callers. The system will have separate telephone ports for ASCII and Baudot terminals.

Interested individuals can contact AMRAD, 1524 Springvale Avenue, McLean, Virginia 22101.

USC RESEARCHES FUTURE OF PERSONAL COMPUTERS

In less than 10 years, more than 50% of American homes will have a personal computer system, according to a recent study by researchers at the University of Southern California.

"We project that 40 million personal computers will have been sold to first-time users by 1990. That would mean one unit for every two American households," said Jack Nilles, principle investigator of the study and director of USC's Office of Interdisciplinary Programs.

The USC team began its study with an analysis of the current state of small computer technology. After this evaluation, the team made a survey, in late 1978, of the early users and uses of the devices.

The survey revealed that 80% of the owners used computers at work or worked closely with someone who did. The main uses for personal computers by the survey respondents were video games, board games and text editing.

This survey on users and uses of personal computers is only the first phase of a three-part project funded by a grant from the National Science Foundation.

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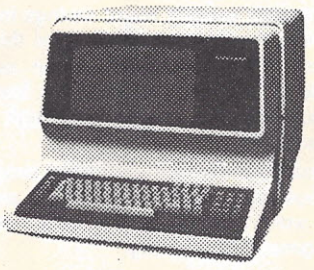

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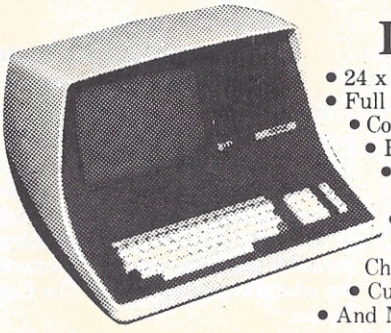

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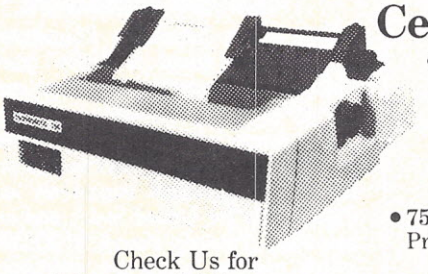

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CIRCLE INQUIRY NO. 39

ELECTRONIC MAIL SYSTEM FOR ALASKA'S SCHOOLS

Gnat Computers, Inc. of San Diego, California, has just completed a contract to supply 59 microcomputers for the new electronic mail system linking Alaska's statewide school districts with the state's Department of Education in Juneau. The general contractor was Transalaska Data Systems, Inc. in Anchorage, and the total contract was for approximately $900,000.

The state expects major savings in communications costs as a result of this new system. The computers will be used to create a "file" of information from the districts and then transmit it at high speed to Juneau.

Besides the communications programs, the System 9 will be used for data processing, word processing, attendance records and general accounting.

EDUCATION GROUP FOR COMPUTER RETAILERS

The Computer Forum, a regional computer learning center located in Red Bank, New Jersey, has announced the establishment of The Computer Forum Education Group for computer retailers. Membership in the group is open to small business and personal computer retailers cooperating in the educational programs of The Computer Forum.

Participating retailers use The Computer Forum to extend their capabilities to serve their own customers. Students may be enrolled in the Forum's short courses, seminars and workshops directly by the dealer. Dealers may also conduct their own private classes at The Forum or use The Forum to train their own sales personnel.

For more information contact Alan B. Salisbury, VP, (201) 530-9103.

APPLE EDUCATION FOUNDATION AWARDS 15 GRANTS

The Apple Education Foundation announced the award of fifteen grants for development projects in education and training using microcomputers.

The grants, recently made to educational developers throughout the country, promise to have a significant impact on teaching materials in the United States and in other countries. Totaling almost $100,000, the grants provide twenty-two microcomputer systems and support equipment for development projects in classrooms ranging from preschool through college, and including special education, health, and adult education studies.

Apple Computer, Inc. provided the foundation's initial funding and contributed most of the equipment awarded under the grant program. All twenty-two computers awarded as part of the new grants are Apple II personal computer systems.

BRAZIL TELEPHONE TRAFFIC CONTROL SYSTEM

Embratel of Brazil inaugurated its $8.3 million telephone traffic control system called the System for the Supervision and control of Traffic and Communications. Installed in the Rio de Janeiro Central Control Office, the SSCTC identifies congested telephone traffic routes, allows calls to be rerouted, and also pinpoints faulty equipment in less than an hour, an operation that previously took up to three days.

The SSCTC utilizes two Alston ATEMIS systems to collect individual lead data from 220,000 data collection points. An Alston ARCS system is used to route traffic and display the status of 5,000 toll lines throughout Brazil on a traffic panel which is updated every five minutes. A video display terminal is used to issue commands to the system, and teleprinters in each of the Embratel offices receive equipment maintenance data from the ATEMIS systems.

LOGICS ONE EDUCATIONAL COMPUTING CONSULTING SERVICE

An educational consulting service has been created in Utica, Michigan to help teachers and administrators take advantage of powerful, low-cost microcomputer technology.

The new service, Logics One, will help a school district determine its instructional computer needs; locate, design and evaluate courseware and facilities; conduct training programs; prepare applications for grants and matching funds; and purchase equipment at the lowest available prices. Similar services will also be provided to meet schools' administrative needs.

Logics One has been formed by educators who have pioneered the use of microcomputers in public school classrooms.

For more information contact Logics One, Box 41, Utica, MI 48087.

COMPUTER EVALUATES NEW FUEL CONVERSION PROCESSES

Researchers at Thagard Oil in Irvine, California, are using a computer for analysis of thermal reactor operations to examine the economic impact of alternate fuel processes. The computer, a Digital Equipment Corporation VAX-11/780, is performing analyses in such areas as coal gasification; conversion of municipal refuse, sewage, or agricultural waste products to fuel; and extraction of energy from oil shale.

A local power utility, Southern California Edison, recently signed an agreement with Thagard to investigate fuel conversion processes. Edison hopes the research will help reduce the utility's present reliance on costly imported low-sulphur oil fuels.

The computer is being used in conjunction with a high-temperature chemical reactor patented in 1976. The unit consists of a porous refractory reaction tube which is heated by 480-volt, three-phase electrodes

in a highly efficient radiation shield which minimizes thermal loss.

The thermal reactor, which is located at Thagard Oil's South Gate, California refinery, is connected to a MINC laboratory computer system. The MINC-based computer system gathers data through 32 data channels and simultaneously records the data on floppy disks and forwards them to the VAX-11/780 via a computer network.

THE APPLE CART

A new special interest group has been formed within American Mensa. The Group, The Apple Cart, is primarily for owners of Apple Computers. It publishes a newsletter and operates a software exchange for its members.

Annual dues are $4 for Mensa members and $6 for those who are not members of Mensa. For more information send a self-addressed stamped envelope to C. Brandon Gresham, Jr., National Coordinator, The Apple Cart, 23 Van Buren Street, Dayton, Ohio 45402.

SOFTWARE MERGER

The merger of KRS Systems Corporation of Westport, Connecticut and TSA Software, Inc. of Monroe, Connecticut into a newly formed company, InfoSoft Systems, Inc., was announced by the KRS and TSA board of directors.

InfoSoft Systems, a Delaware corporation, consolidates the operations of both organizations. KRS, a Data General OEM, has been specializing in software consulting services since 1973. TSA, founded last year from a four-year-old west coast consulting practice, has been developing and marketing microcomputer software.

'INTERNATIONAL APPLE CORE'

The formation of the International Apple Core (IAC), a worldwide independent non-profit Apple Computer users group was recently announced.

The group will act as the parent organization and data center for local Apple user groups, providing members with information about hardware, software, applications notes and programming tips. The IAC will also interface with all appropriate hardware and software companies, so that member groups may quickly be made aware of significant product announcements and enhancements.

Through enrollment in the IAC, local Apple user groups will be able to access and contribute to the IAC library, containing a large quantity of Apple software, as well as product information from software vendors. An IAC newsletter will also be made available to member groups.

For details contact International Apple Core, P.O. Box 976, Daly City, CA 94017, Van Golding (206) 932-6588 or Ken Silverman (415) 878-5382.

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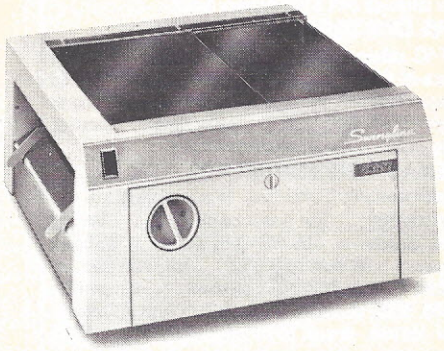

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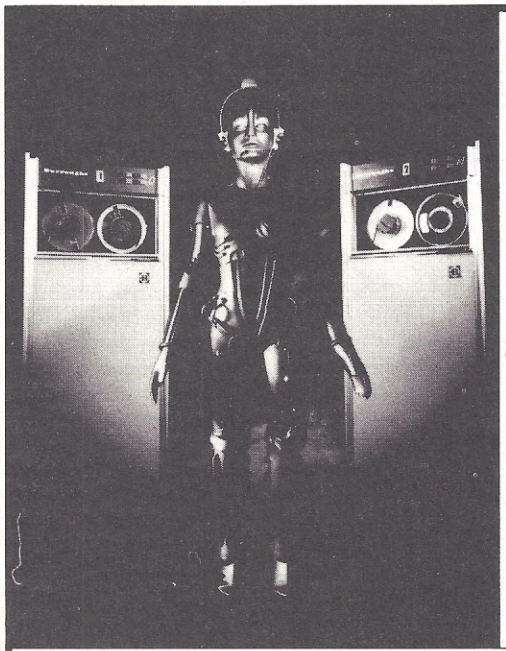

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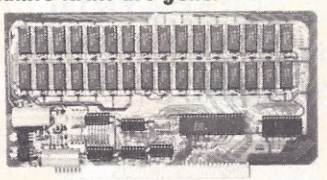

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CIRCLE INQUIRY NO. 71

HP 1000 USERS GROUP

The HP 1000 International Users Group has been recently established. The purpose of the user group is to provide a forum for sharing information among users to enhance their HP 1000 systems, increase their professional development, and to help their development effort for software, firmware and systems. The group will also provide a formal communication channel between the membership and Hewlett-Packard.

In addition, the group will take the responsibility for maintaining and distributing a new and revised contributed program library.

For more information contact HP 1000 International Users Group, P.O. Box 1000, Norwood, MA 02062, U.S.A.

PERSONAL COMPUTER SOCIETY

The International Society of Personal Computerists in Castro Valley, California was organized to promote and advance personal computing on a worldwide basis.

Tid-Bits, the society's newsletter, is intended to be of broad general interest to computer users and hobbyists. The society also publishes several other newsletters of a more specialized nature, tailored to a particular segment of the membership. These include Apple users, Heath users, TRS-80 users, beginners and non-users.

Other society services include free software, free consultation, custom programming, conversions from one BASIC to any other and group discounts on software and hardware purchases.

Membership is open to anyone interested in personal computing for a fee of $15. For more information contact the International Society of Personal Computerists, 4554 Cristy Way, Castro Valley, CA 94546.

'SOUTH CAROLINA APPLE'

South Carolina Apple is an Apple computer users group formed in South Carolina. Demonstrations of Apple programs and peripherals as well as language courses make up the meeting format. A monthly newsletter and software library are available to the membership.

The group meets on the second Tuesday of each month at 7:30 in the evening at the Byte Shop, 1920 Blossom Street, Columbia, SC 29205.

For more information contact South Carolina Apple, Felix Clayton, Pres., 1610 Longview Rd., Mt. Pleasant, SC 29464.

ELECTRONIC MAIL

By the end of the 1980s, users will be spending more than $4 billion per year on electronic mail services and equipment. Although the field will probably be dominated by firms such as AT&T, IBM and GTE, at least fifty other suppliers are expected to be active in more than a dozen specialty niches, according to a 233-page report from International Resource Development Inc., a management consulting firm. The report, entitled "Electronic Mail in the 1980's," predicts that the U.S. Postal Service will participate in the future electronic mail market through new and ambitious service offerings; however, the IRD consultants believe that the USPS will end up with only about one quarter of the market.

New devices for sending and receiving electronic mail, including high-speed printers to be used in conjunction with the Satellite Business Systems wideband satellite communications service, are expected to emerge, according to the report. But the most important elements in future electronic networks will be "intelligent" communications versions of the familiar office copier, telephone and typewriter.

For details contact Ken Bosomworth, International Resource Development, Inc., 30 High St., Norwalk, CT 06851.

ADR LICENSED TO EXPORT SOFTWARE

Applied Data Research, Inc., a computer software company, announced that it had been granted licenses from the U.S. Department of Commerce to export its software products to Bulgaria and the Soviet Union.

Both the city of Moscow and the Bulgarian Committee for the Unified Systems of Social Information have obtained ADR to use The Librarian, ROSCOE, AUTOFLOW II, ETC (Extended Text Compositor), ASC (Automated System Charter), MetaCOBOL and LOOK.

GRUMMAN DATA SYSTEMS

The Air Force Systems Command has awarded a $29.1 million contract to Grumman Data Systems Corporation for the design and installation of the Test Instrumentation System (TIS), a real-time test data processing system for the Aeropropulsion System Test Facility (ASTF), in Tullahoma, Tennessee.

This award is the last of the government-furnished equipment contracts for the ASTF project.

The Aeropropulsion System Test Facility at AEDC is designed to meet the testing requirements of prototype engines for aircraft for the next 20 to 25 years. The $437 million ASTF will simulate actual flight conditions from sea level to 100,000 feet at speeds to mach 3.8 and will accommodate engines delivering up to 75,000 pounds of thrust.

NATIONAL AND MOTOROLA

Motorola and National Semiconductor have signed an agreement that will allow National to manufacture and sell Bipolar VLSI circuits derived from the Motorola Macrocell Array.

The Macrocell Array is an extension of the earlier gate array concept, but represents a more efficient use of chip space. Time and price savings are achieved through computer storage of the cell specifications so the final chip layout can be done by the computer directly from the customer's inputs.

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(Level "A" makes a perfect OEM controller for industrial applications and is available in a special Hex Version which can be programmed using the Netronics Hex Keypad/Display.)

Level "A" at $129.95 is a complete operating system, perfect for beginners, hobbiests, or industrial controller use.

PC Board: glass epoxy, plated through holes with solder mask • **I/O:** provisions for 25-pin (DB25) connector for terminal serial I/O, which can also support a paper tape reader ...provision for 24-pin DIP socket for hex keyboard/display...cassette tape recorder input...cassette tape recorder output...cassette tape control output...speaker output... LED output indicator on SOD (serial output) line...printer interface (less drivers)...total of four 8-bit plus one 6-bit I/O ports • **Crystal Frequency:** 6.144 MHz • **Control Switches:** reset and user (RST 7.5) interrupt...additional provisions for RST 5.5, 6.5 and TRAP interrupts onboard • **Counter/Timer:** programmable, 14-bit binary • **System RAM:** 256 bytes located at F8ØØ, ideal for smaller systems and for use as an isolated stack area in expanded systems...RAM expandable to 64k via S-100 bus or 4K on motherboard.

System Monitor (Terminal Version): 2k bytes of deluxe system monitor ROM located at FØØØ leaving ØØØØ free for user RAM/ROM. Features include tape load with labeling ...tape dump with labeling...examine/change contents of memory ...insert data...warm start...examine and change all registers...single step with register display at each break point, a debugging/training feature...go to execution address... move blocks of memory from one location to another...fill blocks of memory with a constant...display blocks of memory ...automatic baud rate selection...variable display line length control (1-255 characters/line)...channelized I/O monitor routine with 8-bit parallel output for high speed printer... serial console in and console out channel so that monitor can communicate with I/O ports.

System Monitor (Hex Version): Tape load with labeling... tape dump with labeling...examine/change contents of memory...insert data...warm start...examine and change all registers...single step with register display at each break point ...go to execution address. Level "A" in the *Hex Version* makes a perfect controller for industrial applications and can be programmed using the Netronics Hex Keypad/Display.

Hex Keypad/Display.

Hex Keypad/Display Specifications

Calculator type keypad with 24 system defined and 16 user defined keys. 6 digit calculator type display which displays full address plus data as well as register and status information.

Level "B" Specifications

Level"B" provides the S-100 signals plus buffers/drivers to support up to six S-100 bus boards and includes: address decoding for onboard 4k RAM expansion select-able in 4k blocks...address decoding for onboard 8k EPROM expansion selectable in 8k blocks...address and data bus drivers for onboard expansion...wait state generator (jumper selectable), to allow the use of slower memories...two separate 5 volt regulators.

Explorer/85 with Level "C" card cage.

Level "C" Specifications

Level "C" expands Explorer's motherboard with a card cage, allowing you to plug up to six S-100 cards directly into the motherboard. Both cage and cards are neatly contained inside Explorer's deluxe steel cabinet. Level "C" includes a sheet metal superstructure, a 5-card gold plated S-100 extension PC board which plugs into the motherboard. Just add required number of S-100 connectors

Level "D" Specifications

Level "D" provides 4k or RAM, power supply regulation, filtering decoupling components and sockets to expand your Explorer/85 memory to 4k (plus the original 256 bytes located in the 8155A). The static RAM can be located anywhere from ØØØØ to EFFF in 4k blocks.

Level "E" Specifications

Level "E" adds sockets for 8k of EPROM to use the popular Intel 2716 or the TI 2516. It includes all sockets, power supply regulator, heat sink, filtering and decoupling components. Sockets may also be used for soon to be available RAM IC's (allowing for up to 12k of onboard RAM).

Order A Coordinated Explorer/85 Applications Pak!

Experimenter's Pak (SAVE $12.50)—Buy Level "A" and Hex Keypad/Display for **$199.90** and get FREE Intel 8085 user's manual plus FREE postage & handling!

Student Pak (SAVE $24.45)—Buy Level "A," ASCII Keyboard/Computer Terminal, and Power Supply for **$319.85** and get FREE RF Modulator plus FREE Intel 8085 user's manual plus FREE postage & handling!

Engineering Pak (SAVE $41.00)—Buy Levels "A," "B," "C," "D," and "E" with Power Supply, ASCII Keyboard/Computer Terminal, and six S-100 Bus Connectors for **$514.75** and get 10 FREE computer grade cassette tapes plus FREE 8085 user's manual plus FREE postage & handling!

Business Pak (SAVE $89.95)—Buy Explorer/85 Levels "A," "B," and "C" (with cabinet), Power Supply, ASCII Keyboard/Computer Terminal (with cabinet), 16k RAM, 12" Video Monitor, North Star 5-1/4" Disk Drive (includes North Star BASIC) with power supply and cabinet, all for just **$1599.40** and get 10 FREE 5-1/4" minidiskettes ($49.95 value) plus FREE 8085 user's manual plus FREE postage & handling!

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Netronics R&D Ltd., Dept. RE 10
333 Litchfield Road, New Milford, CT 06676

Please send the items checked below—

- ☐ **Explorer/85 Level "A" Kit** (ASCII Version), **$129.95** plus $3 p&h.
- ☐ **Explorer/85 Level "A" Kit** (Hex Version), **$129.95** plus $3 p&h.
- ☐ **8k Microsoft BASIC** on cassette tape, **$64.95** postpaid.
- ☐ **8k Microsoft BASIC in ROM Kit** (requires Levels "B," "D," and "E"), **$99.95** plus $2 p&h.
- ☐ **Level "B" (S-100) Kit, $49.95** plus $2 p&h.
- ☐ **Level "C" (S-100 6-card expander) Kit, $39.95** plus $2 p&h.
- ☐ **Level "D" (4k RAM) Kit, $69.95** plus $2 p&h.
- ☐ **Level "E" (EPROM/ROM) Kit, $5.95** plus 50¢ p&h.
- ☐ **Deluxe Steel Cabinet** for Explorer/85, **$49.95** plus $3 p&h.
- ☐ **ASCII Keyboard/Computer Terminal Kit** (features a full 128 character set, upper & lower case, full cursor control, 75 ohm video output convertible to baudot output, selectable baud rate, RS232-C or 20 ma. I/O, 32 or 64 character by 16 line formats, and can be used with either a CRT monitor or a TV set (if you have an RF modulator), **$149.95** plus $2.50 p&h.
- ☐ **Hex Keypad/Display Kit, $69.95** plus $2 p&h.
- ☐ **Deluxe Steel Cabinet** for ASCII Keyboard/Terminal, **$19.95** plus $2.50 p&h.
- ☐ **Power Supply Kit** (±8V @ 5 amps) in deluxe steel cabinet, **$39.95** plus $2 p&h.
- ☐ **Gold Plated S-100 Bus Connectors, $4.85** each, postpaid.
- ☐ **RF Modulator Kit** (allows you to use your TV set as a monitor), **$8.95** postpaid.
- ☐ **16k RAM Kit** (S-100 Board expands to 64k), **$199.95** plus $2 p&h.
- ☐ **32k RAM Kit, $329.95** plus $2 p&h.
- ☐ **48K RAM Kit, $459.95** plus $2 p&h.
- ☐ **64k RAM Kit, $589.95** plus $2 p&h.
- ☐ **16k RAM Expansion Kit** (to expand any of the above up to 64k), **$139.95** plus $2 p&h each.
- ☐ **Intel 8085 cpu User's Manual, $7.50** postpaid.
- ☐ **Special Computer Grade Cassette Tapes, $1.90** each or **3 for $5**, postpaid.
- ☐ **12" Video Monitor** (10 MHz bandwidth), **$139.95** plus $5 p&h.
- ☐ **North Star Double Density Floppy Disk Kit** (One Drive) for Explorer/85 (includes 3 drive S-100 controller, DOS, and extended BASIC with personalized disk operating system—just plug it in and you're up and running!), **$699.95** plus $5 p&h.
- ☐ **Power Supply Kit** for North Star Disk Drive, **$39.95** plus $2 p&h.
- ☐ **Deluxe Case** for North Star Disk Drive, **$39.95** plus $2 p&h.
- ☐ **Experimenter's Pak** (see above), **$199.90** postpaid.
- ☐ **Student Pak** (see above), **$319.85** postpaid.
- ☐ **Engineering Pak** (see above), **$514.75** postpaid.
- ☐ **Business Pak** (see above), **$1599.40** postpaid.

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ASCII/BAUDOT, STAND ALONE

Computer Terminal

COMPLETE FOR ONLY... $149.95

The Netronics ASCII/BAUDOT Computer Terminal Kit is a microprocessor-controlled, stand alone keyboard/terminal requring no computer memory or software. It allows the use of either a 64 or 32 character by 16 line professional display format with selectable baud rate, RS232-C or 20 ma. output, full cursor control and 75 ohm composite video output.

The keyboard follows the standard typewriter configuration and generates the entire 128 character ASCII upper/lower case set with 96 printable characters. Features include onboard regulators, selectable parity, shift lock key, alpha lock jumper, a drive capability of one TTY load, and the ability to mate directly with almost any computer, including the new Explorer/85 and ELF products by Netronics.

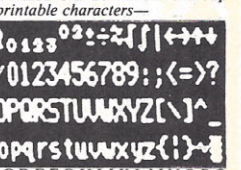
The Computer Terminal requires no I/O mapping and includes 1k of memory, character generator, 2 key rollover, processor controlled cursor control, parallel ASCII/BAUDOT to serial conversion and serial to video processing—fully crystal controlled for superb accuracy. PC boards are the highest quality glass epoxy for the ultimate in reliability and long life.

VIDEO DISPLAY SPECIFICATIONS

The heart of the Netronics Computer Terminal is the microprocessor-controlled Netronics Video Display Board (VID) which allows the terminal to utilize either a parallel ASCII or BAUDOT signal source. The VID converts the parallel data to serial data which is then formatted to either RS232-C or 20 ma. current loop output, which can be connected to the serial I/O on your computer or other interface, i.e., Modem.

When connected to a computer, the computer must echo the character received. This data is received by the VID which processes the information, converting to data to video suitable to be displayed on a TV set (using an RF modulator) or on a video monitor. The VID generates the cursor, horizontal and vertical sync pulses and performs the housekeeping relative to which character and where it is to be displayed on the screen.

Video Output: *1.5 P/P into 75 ohm (EIA RS-170)* • **Baud Rate:** *110 and 300 ASCII* • **Outputs:** *RS232-C or 20 ma. current loop* • **ASCII Character Set:** *128 printable characters—*



BAUDOT Character Set: *A B C D E F G H I J K L M N O P Q R S T U V W X Y Z - ? : * 3 $ # ( ) . , 9 0 1 4 ! 5 7 ; 2 / 6 8* • **Cursor Modes:** *Home, Backspace, Horizontal Tab, Line Feed, Vertical Tab, Carriage Return. Two special cursor sequences are provided for absolute and relative X-Y cursor addressing* • **Cursor Control:** *Erase, End of Line, Erase of Screen, Form Feed, Delete* • **Monitor Operation:** *50 or 60Hz (jumper selectable.*

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Please send the items checked below—

- ☐ **Netronics Stand Alone ASCII Keyboard/Computer Terminal Kit, $149.95** plus $3.00 postage & handling.
- ☐ **Deluxe Steel Cabinet** for Netronics Keyboard/Terminal In Blue/Black Finish, **$19.95** plus $2.50 postage and handling.
- ☐ **Video Display Board Kit** alone (less keyboard), **$89.95** plus $3 postage & handling.
- ☐ **12" Video Monitor** (10 MHz bandwidth) fully assembled and tested, **$139.95** plus $5 postage and handling.
- ☐ **RF Modulator Kit** (to use your TV set for a monitor), **$8.95** postpaid.
- ☐ **5 amp Power Supply Kit** In Deluxe Steel Cabinet (±8VDC @ 5 amps, plus 6-8 VAC), **$39.95** plus $2 postage & handling.

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This family of RUGGED, LOW COST printers prints alpha-numerics and graphics using new, unique 12 v solenoids (Pat. Pend). Driver electronics requires ASCII parallel or RS-232 inputs for 96 char set. Requires pressure sensitive paper for 1-3 copies.

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DMI-40E	40 col. Electronics board	150.00
DMI-80	80 col. Printer (to 90 LPM)	216.00
DMI-80E	80 col. Electronics board	180.00
DMI-40T	40 col. Terminal 115/230v, 50/60 Hz	*$525.00

*Direct consumer price for this complete stand alone terminal. Orders accompanied with payment are shipped prepaid within continental U.S.. N.Y. residents add 7% sales tax.

All other prices FOB, Ithaca, NY NET 30 DAYS.

CALENDAR

DATA COMMUNICATIONS CONFERENCE & SHOW

Data 80 will be held at the Harbour Castle Hilton Hotel and Convention Centre in Toronto, Ontario, February 12-14. Some of the subject areas will be distributed data processing, digitized voice, fibre optics, satellite transmission and communications hardware and software.

For more information contact Jill Carrothers, Conference Coordinator or Laurie Whitsed, Show Coordinator, 2 Bloor Street West, Suite 2504, Toronto, Ontario M4W 3E2, Canada.

COMPUTER SYMPOSIUM

A *Small Computer Symposium* will be held on the University of Tennessee, Knoxville campus during the weekend of February 23. The Symposium is sponsored jointly by the MicroComputer Club and the local student chapters of IEEE and ACM.

This symposium will present a forum for the display and discussion of small computers in the areas of hobby, education and business.

All potential exhibitors, whether individual, educational or commercial should contact Mike Sappington, 8 Ayres Hall, University of Tennessee, Knoxville, TN 37916 for more information.

OFFICE AUTOMATION CONFERENCE

The NCC Office Automation Conference will be held March 3-5 in the Georgia World Congress Center, Atlanta, Georgia.

OAC's program is designed to be a point of reference for future discussion of the industry. The conference's seminars, tutorials, panels, workshops and special events will explore the general categories of administrative management, data processing, electronic mail, micrographics, records management, reprographics, voice technology, word processing and telecommunications.

For details contact Jerry Chiffriller, 1815 N. Lynn St., Suite 805, Arlington, VA 22209, (703) 243-4100.

HANDS-ON WORKSHOPS

The Virginia Polytechnic Institute and State University will be holding three workshops which include Digital Electronics for Instrumentation and Automation, March 10-11; 8080-8085-Z80 Microcomputer Interfacing, Design and Software, March 12-14; and TRS-80 Interfacing and Programming for Instrumentation & Control, March 17-18.

These are hands-on workshops with the participants having the opportunity to retain the equipment.

For more information contact Dr. Linda Leffel, CEC, Virginia Tech, Blacksburg, VA 24061, (703) 961-5241.

WEST COAST SHOW

California Computer Show will be held March 13 at the Inn At The Park in Anaheim, California.

OEM and end-user computer and peripheral products will be exhibited and demonstrated at the show.

For details contact Norm De Nardi, 95 Main Street, Los Altos, CA 94022, (415) 941-8440.

COMPUTER FAIRE RESCHEDULED

The Fifth West Coast Computer Faire has now been finalized and will take place in San Francisco's Civic Auditorium & Brooks Hall, March 14-16.

This is a change from an original proposal that the 5th Faire be held in Los Angeles next November — a proposal cancelled some months ago. This is also a change from a more recently announced date in San Francisco.

Those interested in more information should contact Jim Warren, (415) 851-7075.

MEDICAL COMPUTING COURSE

The Frontiers of Medical Computing, a course held on March 14 and 15, explains recent advances in medical information systems in an institutional context. It discusses computerized patient monitors, computer imaging, and computer-aided diagnosis.

The course will be held at the Academy of Medicine, 288 Bloor West, Toronto. For more information contact Mary Anne Carswell at (416) 922-1937.

INTERFACE '80

Interface '80, the eighth annual presentation of the original Data Communications Conference and Exposition will be held March 17-20 at the Miami Beach Convention Center, Miami Beach, Florida.

For more information contact the Interface Group, 160 Speed St., Framingham, MA 01701, (800) 225-4620; in Massachusetts (617) 879-4502.

POLYTECHNIC WORKSHOP

The workshop from Polytechnica Institute will be held March 20-22 in Dallas, Texas.

It is a three day Hands-On Microprocessor Peripherals Workshop with a nominal cost computer take-home option. Registration fee is $795.

For details contact Paul A. Willis, (703) 533-2826 or Polytechnica Institute, P.O. Box 29, Arlington, VA 22210.

DATA ENTRY MANAGEMENT & SUPERVISION SEMINAR

Management Information Corporation's three-day seminar will be held in Cherry

CIRCLE INQUIRY NO. 26

Hill, New Jersey, on March 24-26.

The seminar will cover such topics as data entry systems concepts, data entry control techniques, personnel motivation and improving data entry productivity. All of the instructors have had experience in managing a data entry department and have encountered many of the problems common to supervisors and managers.

For registration fees and details contact MIC, 140 Barclay Ctr., Cherry Hill, NJ 08034, (609) 428-1020.

COMPUTER SCIENCE & ENGINEERING COURSES

Computer Science Education Extension will offer a series of short courses related to Computer Science and Engineering. The spring schedule consists of:

Principles of Database Systems in New York City, March 24-27; and in San Francisco June 16-18

Computer Picture Processing and Graphics in New York City, June 2-4

Programming in Pascal in San Francisco March 24-28

For more information contact Computer Science Education Extension, Computer Science Press, Inc., 9125 Fall River Lane, Potomac, MD 20854, (301) 299-2040.

INTERNATIONAL EXHIBITION AND CONFERENCE

Viewdata 80, an international exhibition and conference on viewdata, teletext and TV-based information systems, will be held in London, England, March 26-28.

The Conference has been segmented into a three-stream parallel program with both morning and afternoon sessions. Topics include: Videotex in the U.S., Canada, the U.K. and other nations; viewdata applications in travel, finance, education, the media, the office and electronic publishing; in-house videotex systems; international videotex standards; and a review of the developments on the horizon.

For more information contact Technology Marketing Analysis Corp., 680 Beach St., Suite 428, San Francisco, CA 94109.

REGIONAL CONFERENCES

Expo '80, a comprehensive showcase of computer and office systems, will bring the latest in technology and information management to businesses in nine major cities.

Featured at the conference will be a wide selection of small business systems, electronic mail equipment, software products, word processing systems, general information handling equipment, CRT graphic systems and much more.

Expo '80 will start at the San Mateo, California, Fairgrounds March 19-21. Also at the Los Angeles Convention Center, March 25-27; Dallas Market Hall, April 1-3; New York Coliseum, April 22-24; Baltimore Convention Center, April 28-20; Boston Northeast Trade Center, May 6-8; Detroit's Renaissance Center, June 3-5; Chicago Merchandise Mart, June 10-12; and Cincinnati Convention and Exposition Center, June 17-19.

For more information contact The Conference Company at (800) 225-4260; in Massachusetts (617) 964-4550.

RELIABILITY TESTING INSTITUTE

The Sixth Annual Reliability Testing Institute of the University of Arizona will be held on April 14-18 at the Ramada Inn, 404 North Freeway, Tucson, Arizona.

The objective of the program is to provide reliability engineers, product assurance engineers, managers and teachers with a working knowledge of analyzing component, equipment and system performance and failure data.

For details contact Dr. Dimitri Kececioglu, Institute Director, Univ. of Arizona, Bldg. 16, Tucson, AZ 85721.

MATHEMATICIANS' MEETING

The Program Committee has been appointed and plans are getting underway for the National Council of Teachers of Mathematics' 59th Annual Meeting. This convention will be held in St. Louis, Missouri on April 22-25.

For information contact Geraldine Green, 8058 Balfour, Allen Park, MI 48101.

INTERNATIONAL DP TRAINING CONFERENCE

The 1980 International DP Training Conference has been scheduled for April 23-25 at the Hyatt Regency in Chicago. The theme for this 5th annual event will be "The 1980s: The Information Decade."

The conference is a symposium for internationally prominent DP experts and corporate training executives. The International DP Training Conference is sponsored by Deltak, Inc., Oak Brook, IL.

For more details contact Deltak, Inc., 1220 Kensington Rd., Oak Brook, IL 60521, (312) 920-0700, Sharon Trube.

NUMERICAL CONTROL SOCIETY EXPOSITION

The 17th Annual Numerical Control Society Meeting and Technical Conference will be held April 27-30 at the Hartford Civic Center in Hartford, Connecticut.

There will be technical sessions with topics including Computer Aided Design Applications, Computer Aided Manufacturing Applications, Numerical Control, Database Structure & Management and educational programs.

Interested parties can contact Exhibits Coordinator, Numerical Control Society at 519-520 Zenith Dr., Glenview, IL 60025, (312) 297-5010.

■ Complete Sub-System: DRIVE, CONTROLLER, and CABLES for S100 computers ■ Uses the most popular drive for small business systems ■ 10 Megabyte formatted capacity ■ 5MB fixed platter plus ■ 5MB 5440 removable cartridge for FAST BACK-UP and UNLIMITED off line STORAGE ■ Look Ahead buffer for maximum performance ■ expandable to 40 MB ■ Supported by CP/M 2.0, MP/M, Oasis, Famos, Fordos, Tempos Operating Systems ■ Beautiful teak finish table top (shown) enhances any office decor Rack mount also available ■ Dealers/OEMs contact John Costello.

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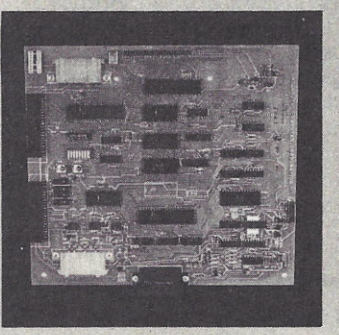
Baud News

Published by Datasouth Computer Corporation, 627-F Minuet Lane, Charlotte, NC 28210.



For LA36 Owners, 1200 Baud Breakthrough

CHARLOTTE A spokesman for Datasouth Computer Corp. confirmed reports of LA36 DECwriters® printing at blazing speed. With Datasouth's DS120 Terminal Controller, the LA36 prints bidirectionally at speeds up to 165 cps with true 1200 baud throughput. A 1000 character internal print buffer eliminates the need for fill characters.

Well-Endowed With Features

Versatile performance features include complete forms control and data formatting capability programmable from either the keyboard or data stream; plus both an EIA RS232-C and 20mA Current Loop interface.

Easy Installation

This blazing speed is accomplished by replacing the LA36 logic card with the DS120 unit—which is fully compatible with existing electronics.

Results Are In

As BAUD NEWS went to press, DS120's were providing enhanced speed and versatility for more than 3000 LA36 owners. The microprocessor-based electronics have proven very reliable, and service, when needed, has been prompt and efficient. Of course, the DS120 comes with a 90-day warranty on materials and workmanship.

Delivered Nationwide

Datasouth reports a network of stocking distributors in major cities throughout the U.S. for prompt service and delivery. The spokesman added that he welcomes inquiries and will gladly give you all the details on the DS120. He can be called at 704/523-8500 or addressed at Datasouth's office, 627-F Minuet Lane, Charlotte, N.C. 28210.

DEC is a registered trademark of Digital Equipment Corporation.
Installation of the DS-120 will void any DEC warranty or service contract.

PASCAL WORKSHOP

Polytechnic Institute of New York and the Institute for Advanced Professional Studies are presenting an intensive seminar for engineers, programmers, and technical managers.

"Pascal Programming for Mini and Microcomputers" will be held on April 25-26 and May 1-3 at the Polytechnic Westchester Center, White Plains, NY.

Tuition is $600 and includes extensive course notes, text, and evening reception. For details contact Prof. Donald D. French at (617) 964-1412 or the Institute for Advanced Professional Studies, One Gateway Cir., Newton, MA 02158.

NCC 1980

The 1980 National Computer Conference, sponsored by the American Federation of Information Processing Societies, Inc., The Association for Computing Machinery, the Data Processing Management Association, the IEEE Computer Society and the Society for Computer Simulation, will be held at the Anaheim Convention Center in Anaheim, California.

The Conference will be held May 19-22. For more information contact Barmmer Elliott, Inc., Victor Cavallo, (203) 356-9411.

MOTION CONTROL SYMPOSIUM

The Ninth Annual Symposium on Incremental Motion Control Systems and Devices will be held at the Ramada Inn in Champaign, Illinois, June 2-5.

Authors who submitted papers for this symposium are reminded that final manuscripts will be due around mid-March.

For more information contact Prof. B.C. Juo, P.O. Box 2772, Station A, Champaign, IL 61820, (217) 333-4341.

COMPUTER CAMP

This summer, youngsters can sign up for a week long camp in Moodus, Connecticut where the main activity will be computers.

During the week June 29-July 4 campers from ages 10-17 will enjoy small group instruction and mini and microcomputers for ample "hands-on" experience.

The camp is for kids of all levels of experience including no experience whatsoever. For more information contact Michael Zabinski, (203) 795-9069 or write Computer Camp, Grand View Lodge, Box 22, Moodus, CT 06469.

DATES SET FOR PC '80

The Fifth Annual Personal Computing and Small Business Computer Show, PC '80, will be held on October 9-12 at the Philadelphia Civic Center.

For more information contact John Dilks, Personal Computing '80, Route 1, Box 242, Ward Rd., Mays Landing, NJ 08330, (609) 653-1188.

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Look to Howard W. Sams & Co., Inc.

There's something for everyone—from those who want to discover what computers are all about to those who are already utilizing computers and programming. The fundamentals . . . programming . . . interfacing . . . logic—we are the complete knowledge source for home, business, educational and professional users.

The "Starters"

☐ **How To Buy & Use Minicomputers and Microcomputers**
by Barden.
A single source to buying and using a computer in your home or business to handle recreational or practical tasks from playing games to setting up a burglar alarm. 240 pages, No. 21351, $9.95

☐ **The Howard W. Sams Crash Course in Microcomputers**
by Frenzel.
The first complete crash course in microcomputers for everyone—from the average consumer to the Doctor of Science. 264 pages, No. 21634, $17.50

☐ **Getting Acquainted With Microcomputers**
by Frenzel.
Gives you a complete working knowledge of the microcomputer-organization, operation, and programming. 288 pages, No. 21486, $8.95

☐ **Fundamentals of Digital Computers** (2nd Ed.)
by Spencer.
Unravels the mysteries of computers and programming. 320 pages, No. 21534, $9.95

☐ **Introduction to Microcomputers for the Ham Shack**
by Helms.
Gives the radio amateur an opportunity to be in the forefront of utilizing and developing techniques in "computercations." 96 pages, No. 21681, $4.95

Prepub Offer—Save 10% (expires 3/31/80)

☐ **Microcomputer Primer,** (2nd Ed.) NEW
by Waite and Pardee.
Completely revised and broadened to reflect the latest advances in microprocessor technology from the new 8-bit microprocessors to solderless breadboards. An excellent starting point for all those interested in computers. Approximately 368 pages, No. 21653, Prepub price—$10.75. Regular Price—$11.95

The "Programmers"

☐ **How to Program Microcomputers**
by Barden.

A popular, complete guide to assembly language programming of the Intel 8080, Motorola MC6800, and MOS Technology MCS 6502 Microprocessors. 256 pages, No. 21459, $8.95

☐ **BASIC Programming Primer**
by Waite and Pardee.
Covers everything from getting organized to writing a game program. 240 pages, No. 21586, $8.95

☐ **DBUG: An 8080 Interpretive Debugger**
by Titus and Titus.
Covers program operation and how it's applied to program development and testing. 112 pages, No. 21536, $4.95

☐ **6502 Software Design**
by Scanlon.
Tells how to program for the 6502 assembly language. Approximately 288 pages, No 21656, $9.95* NEW

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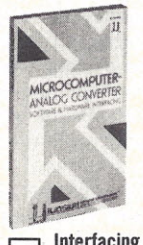

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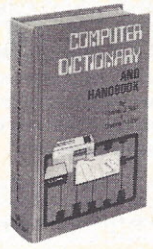

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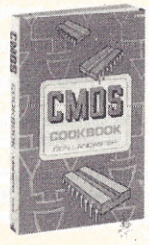

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CIRCLE INQUIRY NO. 22

the Column

By Dr. Robert F. Zant
Dept. of Accounting & Information Systems
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FORMATTING NUMERIC OUTPUT

The capability to format string and numeric output is needed in all types of computing — business, scientific and personal. Microcomputer systems typically provide formatting capabilities for string variables through cursor controls (VTAB and HTAB) and through string functions. However, facilities for formatting numerical output (e.g., the PRINT USING statement) are not available in some widely used versions of BASIC. For instance, while North Star BASIC and TRS-80 Level II BASIC provide such facilities, the Apple II and TRS-80 Level I BASICs do not.

In BASIC systems that do not have formatting capabilities, this capability can be provided by a BASIC language routine that converts a numeric value into a string value with the desired format. The routine which follows, written in Applesoft BASIC, will convert a numeric value into an equivalent string.

The routine provides a FORTRAN-like formatting capability converting the value into a string that is 'W%' characters in length and is rounded to 'D%' decimal places. (The percent sign (%) in the names causes the variable to take on only integer values.) Commas are inserted into the string where appropriate. The string value can then be printed at the desired location using cursor controls.

Lines 110 through 250 in the program are for explanatory and demonstration purposes only. The format routine begins at statement 60000. The statements numbered 601xx check the validity of the values of the variables 'W%' and 'D%'. In this version of the routine, W% is limited to the range 1 to 15 and D% can be no larger than W%–2. This allows a value that is less than one to be printed as '0.xx'.

The next set of statements (numbered 602xx) split the number to be formatted into its integer and decimal components. The integer portion is placed in the string A$, while the rounded decimal portion is placed in C$. The statements numbered 603xx add trailing zeros if the decimal value is less than 'D%' digits in length.

The minimum length of the value being formatted is compared to the maximum field width in the statements numbered 604xx. If the desired width is too small for the value, the formatted string is filled with asterisks.

Commas are added to the integer portion of the number in the section numbered 605xx. The resulting string is concatenated with the decimal portion in line 60600. Finally, control is returned to the calling routine in line 60610.

Additional formatting can be performed on the string returned by the routine. A "floating" dollar sign can be added to the value by the following statement:

```
230 A$ = "$" + A$
```

Or, blanks in the leftmost positions of the field can be replaced by asterisks with the following statement:

```
230 A$ = LEFT$("**********",W%-LEN(A$)) + A$
```

Other editing capabilities such as the use of debit and credit symbols (DB and CR, respectively) or the printing of the sign after the value can also be easily accomplished. Thus, the routine actually offers more flexibility than is available with some implementations of the PRINT USING statement.□

Figure 1. Demonstration Program

```
110  REM   DEMO PROGRAM FOR APPLESOFT
120  REM   NUMERIC FORMAT ROUTINE
130 :
140  REM   WRITTEN BY
150  REM            ROBERT F ZANT
160 :
170  REM  04-01-79
180 :
190 :
200  INPUT "ENTER A VALUE:  ";A
210  INPUT "ENTER W,D:  ";W%,D%
220  GOSUB 60000
230  REM   << PRINT VALUES IN A COLUMN >>
240  HTAB 38 -  LEN (A$):: PRINT A$
250  GOTO 200: REM  INFINITE LOOP
```

Figure 2. Format Program

```
60000  REM   NUMERIC FORMAT ROUTINE
60001  REM   FOR APPLESOFT II BASIC
60002 :
60003  REM   WRITTEN BY
60004  REM      ROBERT F ZANT
60005 :
60006  REM   04-01-79
60007 :
60010  REM   ROUTINE IS FOR VALUES:
60011  REM    .01 < A < 999,999,999.2
60012 :
60013  REM   A  - THE VALUE TO BE FORMATTED
60014  REM   A$ - RETURNED FORMATTED VALUE
60015  REM   W% - MAXIMUM WIDTH OF A$
60016  REM        (0 < W% < 16)
60017  REM   D% - NUMBER OF DECIMAL PLACES
60018  REM        (D% < W%-1)
60019  REM   B% - TEMPORARY STORAGE
60020  REM   C  - TEMPORARY STORAGE
60021  REM   C$ - CONTAINS DECIMAL PORTION
60100  REM  << EDIT W% AND D% >>
60110  IF W% < 1 THEN W% = 1
60111  IF W% > 15 THEN W% = 15
60120  IF D% > W% - 2 THEN D% = W% - 2
60130 :
60210  REM   C  - INTEGER PART THEN
60211  REM        FRACTIONAL PART
60212  REM        ROUNDED TO 'D%' DECIMALS
60213  REM   A$ - AT FIRST CONTAINS ONLY
60214  REM        THE INTEGER PORTION
60215  REM   C$ - FRACTIONAL PART
60216 :
60220 C =  INT ( ABS (A)) *  SGN (A)
60221 A$ =  STR$ (C)
60222  IF D% < 1 THEN C$ = "": GOTO 60400
60223 C =  ABS (A - C)
60224 C =  INT (C * 10 ^ D% + .5) / 10 ^ D%
60225 C$ =  STR$ (C)
60300  REM   NOW C$ CONTAINS '0'   OR
60301  REM                  '.X'  OR
60302  REM                  '.XX' ETC.
60303 :
60310  IF C$ = "0" THEN C$ = ".0"
60311  IF  LEN (C$) < D% + 1 THEN C$ = C$ + "0":: GOTO 60311
60312 :
60400  REM   CHECK FOR SUFFICIENT WIDTH
60401  REM   B% - MINIMUM WIDTH NEEDED
60410 B% =  LEN (A$) +  LEN (C$)
60411  IF B% > W% THEN A$ =  LEFT$ ("**************",W%):: GOTO 6
    0610
60412 :
60500  REM   NOW NEED TO INSERT COMMAS
60501  REM   C - NUMBER OF COMMAS NEEDED
60502  REM        OR MAXIMUM POSSIBLE
60510 C = ( LEN (A$) - 1 - ( SGN (A) =  - 1)) / 3
60511  IF C > W% - B% THEN C = W% - B%
60512 :
60520  REM   READY NOW TO INSERT COMMAS
60521 B% = 3
60522  IF C < 1 THEN 60600
60523 A$ =  LEFT$ (A$, LEN (A$) - B%) + "," +  RIGHT$ (A$,B%)
60524 B% = B% + 4
60525 C = C - 1
60526  GOTO 60522
60527 :
60600 A$ = A$ + C$
60610  RETURN
60700  REM  <><><>  END  <><><>
```


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From the Fountainhead

By Adam Osborne

The views in this column are those of the author and are not necessarily those of the magazine or its staff. Dr. Osborne can be contacted at P.O. Box 1234, Cerritos, CA 90701.

Microcomputer system hardware and software is now of high enough quality to open the door for a new wave of entrepreneurs. This new wave should copy the Original Equipment Manufacturers (OEMs) of the minicomputer world.

Apple, Cromemco, Vector Graphics, and North Star, for example, are hardware manufacturers who have survived the first round of microcomputer industry casualties. Apple, clearly, is the leader in terms of solid company management, finances, and product support.

Minicomputer industry professionals who once laughed at Radio Shack's entry into the computer market now cry more easily than they laugh when the subject of Radio Shack is brought up.

I have had a chance to look at Atari's new 800 Computer; Atari is a well-financed, well-managed subsidiary of Warner Communications. I expect that 800 will give Apple a real run for its money, competing for essentially the same customer base. And we're all still waiting for Texas Instruments to start full delivery of the 99/4.

Who is going to buy all of these computers? I believe we can find many interesting answers to that question if we draw parallels between the microcomputer industry today, and the minicomputer industry as it grew over the past decade.

Nearly all minicomputers were ultimately bought by customers as part of a solution. A minicomputer might have become part of a data processing system or a machine tool controller; but whatever the application, the minicomputer was used with permanent programs; it was rarely programmed by the end user. Programming was handled by a few "in between" companies who bought the minicomputer from the hardware manufacturer, added programs and exterior dressings, then sold the package under their own label. These people were **minicomputer OEMs.**

Up till now, many end users have programmed their own microcomputers. But this does not mean that the microcomputer market differs substantially from the minicomputer market; rather, it is a sign of the microcomputer industry's infancy, and the size to which the microcomputer industry might potentially grow. Maybe there are a very large number of people who have bought microcomputers to program themselves, as compared to the very few who have bought minicomputers to program themselves; but there is a vast, as yet untapped market for microcomputer systems being sold to customers who will never do any programming for themselves.

Yet very few companies have really examined the microcomputer OEM market potential. All we have seen, thus far, are small business computer systems based on micros; and micros have been used widely in industrial controller and instrumentation applications. A vast number of new entrepreneurial opportunities remain to be addressed: the use of microcomputers in education, computer graphics as an art form, and who knows what else? Certainly, if I knew all the possibilities, I would soon become very wealthy.

Anyone who currently owns a microcomputer and is using it in a noncomputer industry application, should look carefully at the possibility that their application might have a very significant commercial potential. I have said it before, and I will say it again: the biggest opportunities

for the future lie in combining your specialized knowledge of some totally unrelated business or industry with your microcomputer.

It is far too late for any small entrepreneur to start building computer hardware; but the **microcomputer OEM era** has barely started. In fact, the microcomputer OEM industry is so new that parts of it may, possibly, still be a few years away. Electronic mail, for example, is here today; but it will be three to five years before every home has an electronic mail terminal sitting next to the TV set. It may take even longer.

The real hold-up is in data communications. The data communications industry must increase its capacity more than a hundred fold in the next decade; and until they make big strides into this increased capacity, data communications costs will keep electronic mail just

The microcomputer industry will, in time, wipe out the minicomputer industry as we know it today.

outside of the average home owner's economic reach. But as soon as every home does have an electronic mail station, whole new markets will open up to entrepreneurs who can use these electronic mail stations as terminals into databases that provide everything from stock brokerage services to travel arrangements.

There are indeed striking parallels between today's microcomputer industry and yesterday's minicomputer industry. Most industry pundits have claimed that these were two separate and distinct industries; but the pundits are wrong. The microcomputer industry is the next wave of the minicomputer industry; from its birth it was a part of the minicomputer industry which minicomputer manufacturers never saw.

The microcomputer industry will, in time, wipe out the minicomputer industry as we know it today. The first to go will be weak minicomputer manufacturers whose primary business is selling hardware to OEMs; hardware which by today's standards is no better than an average microcomputer product.

The last minicomputer manufacturers to succumb will be the big, systems oriented companies such as Digital Equipment Corporation and Data General; they concentrate on selling solutions, although they started out selling hardware to OEMs. But even these giants, I predict, will start to feel pressure from the Apple's and Radio Shack's in years to come, unless they continue to develop microcomputer-type products — which, of course, they have both started to do. DEC has the LSI-11 and Data General has the MicroNova. The point is, minicomputer manufacturers cannot beat microcomputers; they can only join them if they want to survive.

In the months to come, I will describe the adventures and misadventures that have given us our major microprocessor manufacturers today. I will begin with **Texas Instruments.**

Texas Instruments has been very late introducing the TMS 99/4 home computer; this is interesting, because it spotlights the fact that Texas Instruments does not always have to be successful in every microelectronics venture they undertake.

I am not about to suggest that the TMS 99/4 will be unsuccessful. On the contrary, based on what I have seen thus far, I think it will be a very successful product — providing Texas Instruments starts shipping in volume soon, and at a lower price than originally announced.

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price. The TMS1000 has been around for a long time, and it is likely to be with us for a long time to come. It powers more consumer products than most people realize; and in these markets, its low price is important, while its limited performance is adequate.

Texas Instruments' best known microprocessor product is the TMS9900 family of 16-bit microprocessors. The TMS9900 should have had the entire 16-bit marketplace to itself, slamming the door on the 8086, the Z8000 and the 68000; instead, the TMS 9900 is an also ran. Why? Because Texas Instruments never really understood the microprocessor market.

The TMS9900 was introduced by Texas Instruments in 1976 as a low-end version of their TMS990 minicomputer. In 1976 the TMS9900 was so far ahead of any other microprocessor on the market that one had to stand in awe of Texas Instruments' semiconductor design capabilities. But Texas Instruments did not know what they had; they looked on the TMS9900 as a small piece of their minicomputer product line, rather than as a microprocessor product in its own right.

They supported the TMS9900 the way they supported their line of TTL logic, while Intel supported the 8080 with development systems and customer engineers — the type of support a microprocessor product deserves. When Texas Instruments saw the success Intel was having with the 8080, they quickly made their own version of the 8080 — so quickly in fact, that they had an 8080 look-alike out at about the time Intel introduced the 8080A.

As time went by and Texas Instruments was underwhelmed with orders for TMS9900 microprocessors, the company finally put two and two together and came up with five. They decided that a market existed for TMS1000-type products only, and this was the market they should address with the TMS9900. The result was the 9940, a one-chip microcomputer version of the TMS9900. I feel it is an abortion of design concepts if there ever was one. The very design capabilities that made the TMS9900 so powerful are ridiculed by the constraints of the TMS9940. And Texas Instruments has not yet successfully manufactured the TMS9940 in volume.

Is it too late for Texas Instruments? Probably not. Their LSI design capability is so formidable that they would become even more of a power to be reckoned with the moment they truly understand the depth of the microprocessor market, its customer base, and its needs.□

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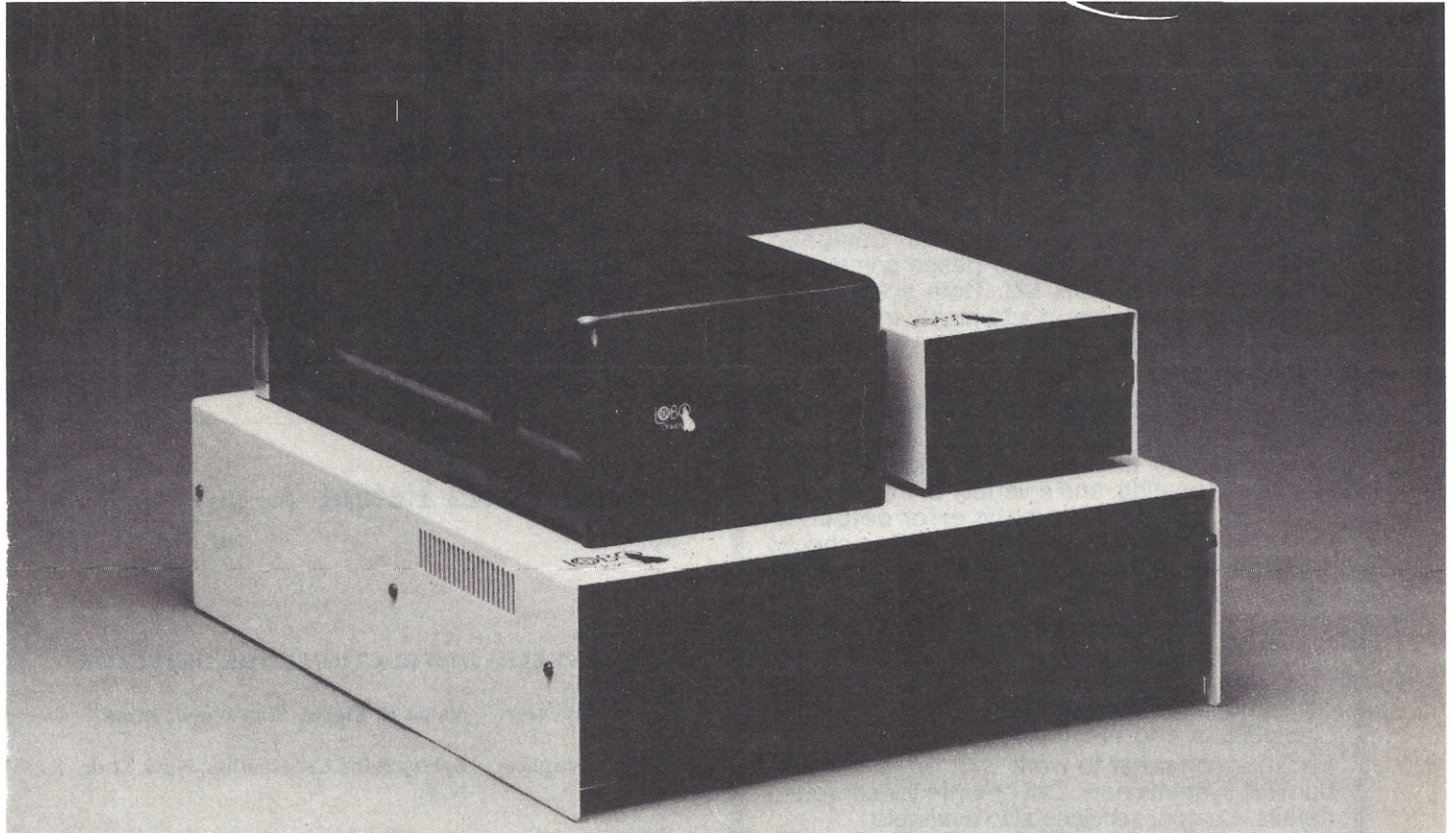

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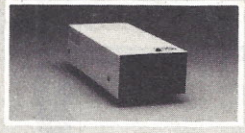

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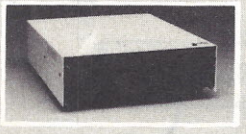

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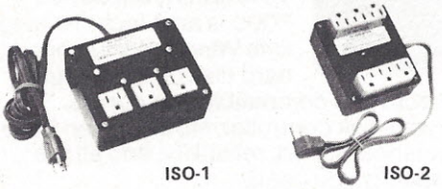

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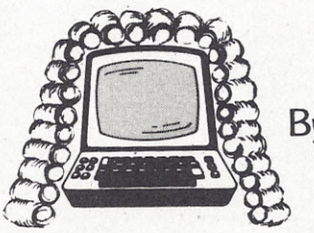


By Leonard Tachner
Attorney-at-Law

United States Patent [19] [11] 4,167,778

Sipple [45] **Sep. 11, 1979**

[54] **INVALID INSTRUCTION CODE DETECTOR**

[75] Inventor: **Ralph E. Sipple, Shoreview, Minn.**

[73] Assignee: **Sperry Rand Corporation, New York, N.Y.**

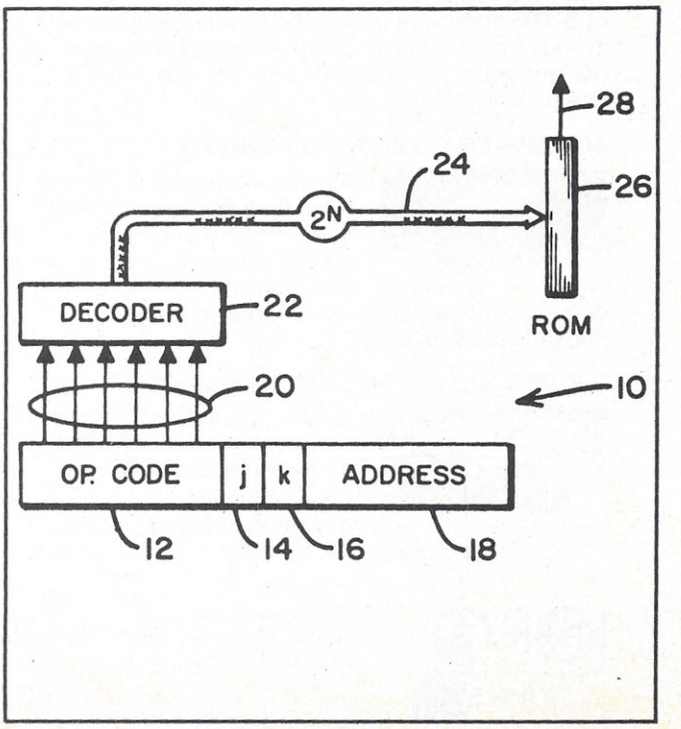
[21] Appl. No.: **873,470**

[22] Filed: **Jan. 30, 1978**

[57] **ABSTRACT**

A read-only memory, adapted to be addressed by the operation code portion of a computer instruction word, stores at addressable locations therein a flag indicating whether a particular combination of operation code bits is a valid combination.

4 Claims, 3 Drawing Figures



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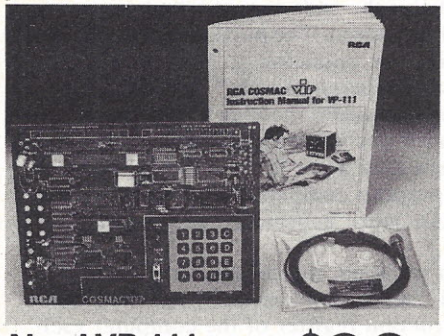

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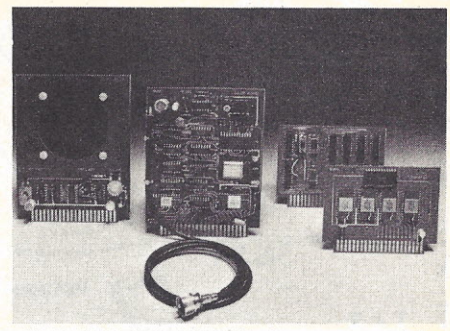

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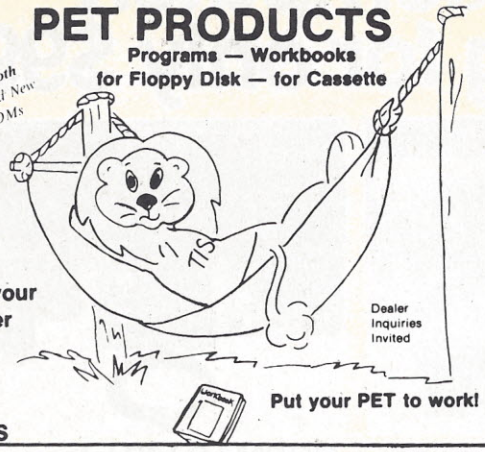

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CIRCLE INQUIRY NO. 6

BACKGROUND OF THE INVENTION

In practically all automatic general purpose digital computers, problems are solved by executing a number of instruction words comprising the computer program. An instruction word is a combination of binary digits (bits) which define the arithmetic or logical operation to be performed and also the addresses at which operands to be manipulated are stored. The portion of the instruction word defining the operation to be performed is commonly called the "operation code" or op. code. The number of discrete operations that can be performed by given computer is a matter of design choice and in prior art computers there may be as few as five instructions for small special purpose computers or more than one hundred for larger, more expensive, general purpose systems.

To obviate this problem, the present invention provides a so-called "read-only" memory (ROM) connected to the instruction register of the computer such that the op. code bits are interpreted as addresses. Stored at each address in the ROM corresponding to an invalid instruction code is a logical "0" signal while a logical "1" signal is stored at each address corresponding to a valid instruction code. Hence, each time a new instruction word is entered into the instruction register, a "1" or a "0" signal, hereinafter referred to sometimes as a "flag" bit, will be read out from the ROM and thereby indicate whether the op. code is valid or invalid, respectively

OBJECTS

It is accordingly an object of the present invention to provide a novel arrangement for sensing and indicating whether an instruction word being processed falls into a predetermined class.

Another object of the invention is to provide a read only memory having stored therein at addressable locations a flag bit indicative of whether the op. code of an instruction word currently in the instruction register of the computer is of a given class.

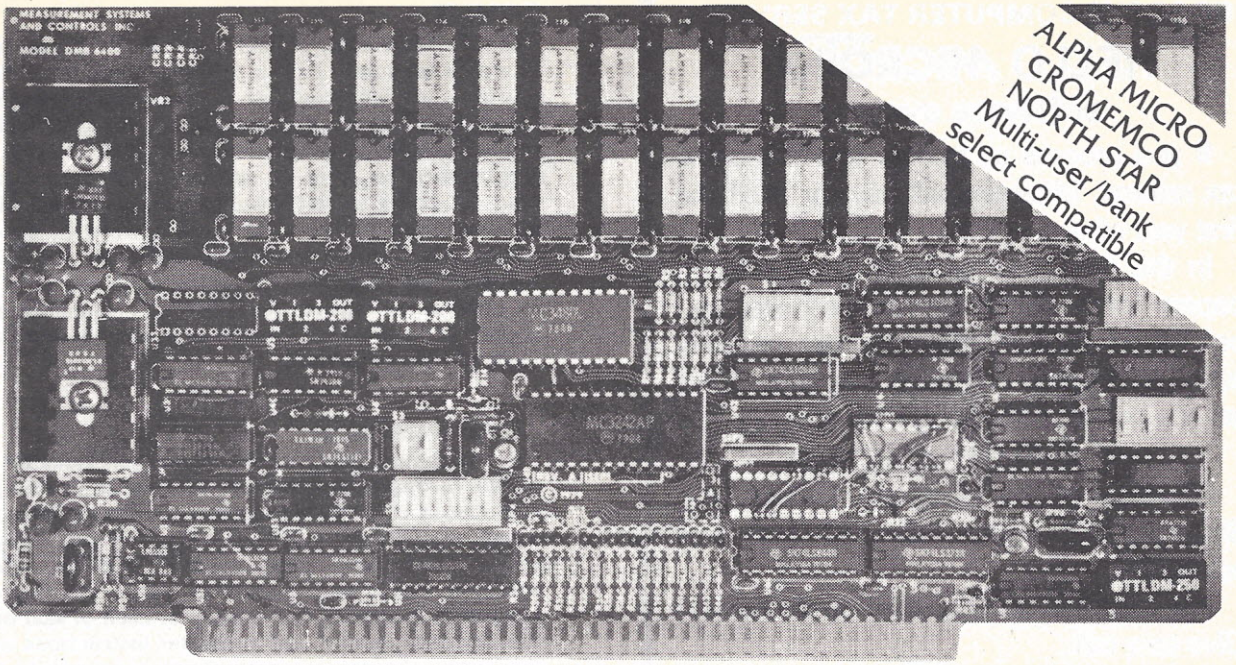
Still another object of the invention is to provide a novel means for indicating the presence of an invalid instruction word in the computer's instruction register.

DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates one embodiment of the invention;

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1 there is shown by means of a logical block diagram, an arrangement for producing a flag bit in the event that the instruction word to be processed is of a predetermined class; more specifically, whether it involves an invalid op. code. As is illustrated, there is provided a stable set of inputs comprising an instruction register 10 adapted to hold an instruction word undergoing processing. The instruction word contained in register 10 may include an op. code portion 12, one or more special designators 14, 16 and a plurality of address bits 18 used to access operands or other instructions from the main memory of the computer. The bits of the instruction word comprising the op. code are applied over the lines 20 to the input of a decoder network 22 which examines the bit permutations



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CIRCLE INQUIRY NO. 63

of the op. code and produces a signal on one of the 2^N lines in cable **24** leading to the read-only memory (ROM) **26**.

In the embodiment of FIG. **1**, the ROM **26** consists of 2^N words each only 1 bit in length. Hence, each time a new op. code is entered into the instruction register **10**, one of the 2^N bit words permanently stored in ROM **26** will be read out on output line **28**. The ROM **26** is pre-programmed to store at addresses corresponding to valid op. codes a 1-bit word of predetermined binary significance (a "1" or a "0") and a word of opposite significance is stored at all other addresses corresponding to invalid op. codes. Therefore, upon entry of a new op. code in the register **10**, either a "1" signal or a "0" signal will appear on line **28** as a flag bit that the op code is valid or invalid.

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a. storing within a read-only memory of capacity 2^N addressable bits, a flag bit corresponding to each of said 2^N possible different operation codes wherein said flag bit is a binary one if said corresponding operation code is defined as valid and a binary zero if said corresponding operation code is not defined as valid;

b. temporarily storing one of said series of computer instructions currently scheduled for execution by said digital computer;

c. decoding said operation code of said temporarily stored one of said series of computer instructions currently scheduled for execution by said digital computer to generate an address of said read-only memory;

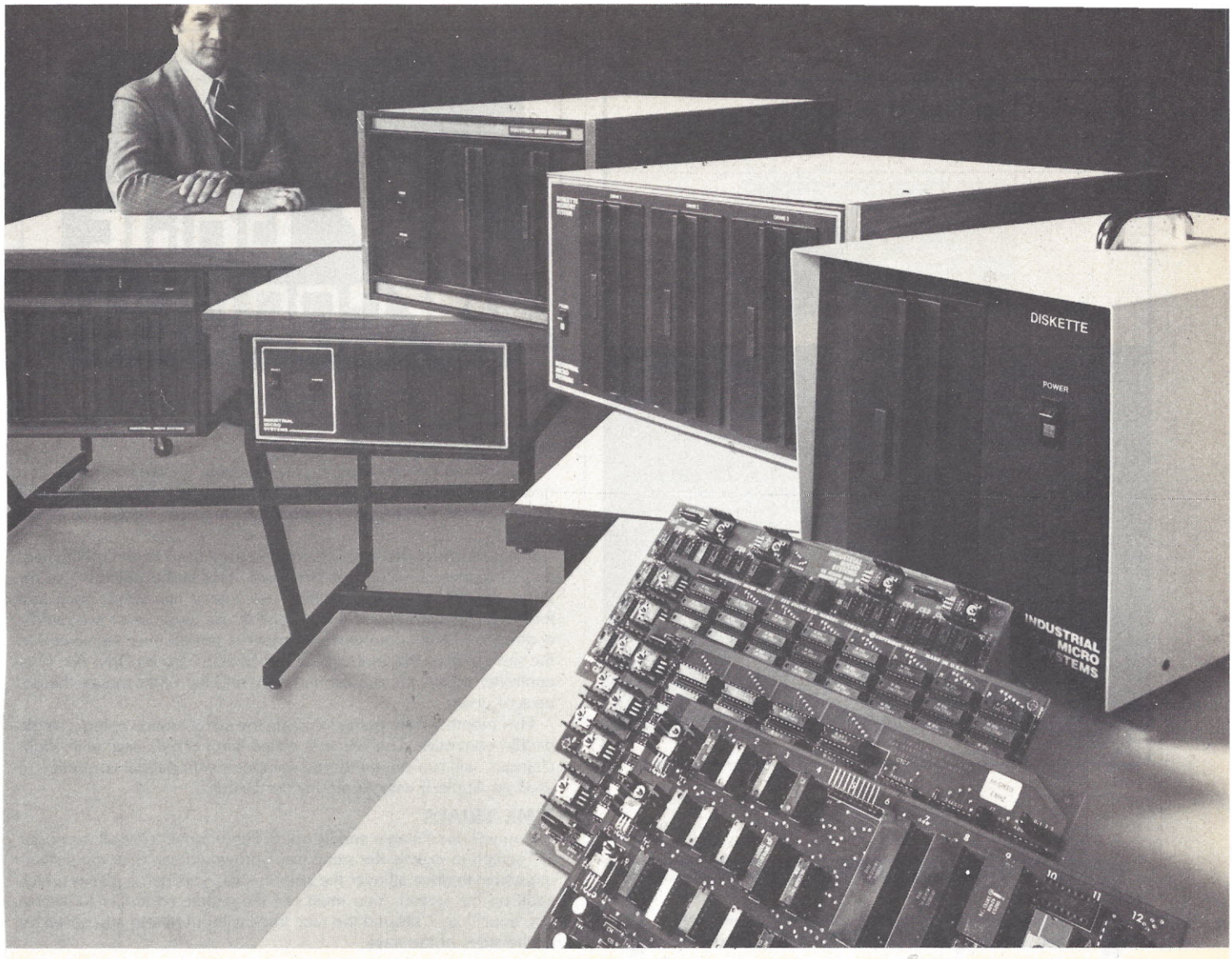
d. accessing said flag bit within said read-only memory at said generated address corresponding to said operation code within said temporarily stored one of said series of computer instructions currently scheduled for execution by said digital computer;

e. signaling said digital computer that said operation code within said temporarily stored one of said series of computer instructions currently scheduled for execution by said digital computer is valid if and only if said accessing revealed that said flag bit corresponding to said operation code is a binary one;

f. executing said temporarily stored one of said series of computer instructions currently scheduled for execution by said digital computer if said accessing revealed that said flag bit corresponding to said operation code is a binary one; and

g. repeating steps b through f for each one of said series of computer instructions.

To contact the author write Jurisprudent Computerist, P.O. Box 1234, Cerritos, CA 90701.



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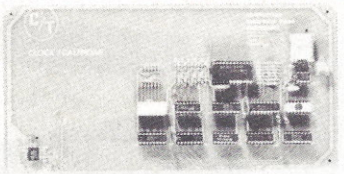

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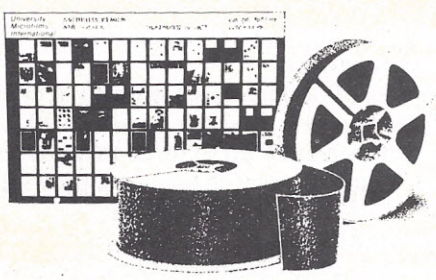

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AL BAKER'S GAME CORNER

By Al Baker

DRIVING YOUR COMPUTER

This month we are going to play with your paddle controllers in a new way. Does your computer have hand-held paddle controllers? They can be purchased for the Atari and are supplied with the Apple II.

It is no surprise that paddle controllers are used to control the paddles in games like Pong or Breakout. This is the obvious use for these devices, since the paddles only move two ways, back and forth. Games that require 4-way motion use joysticks or two paddle controllers. Dual controllers can move a dot all over the screen in the same way as the famous "Etch-A-Sketch" toy by Ohio Art. One controller moves the dot left and right and the other moves the dot up and down.

This month we are going to create the same motion using a single paddle controller. The game is called *Time Trials* and, with slight changes, will run on any home computer with paddle controllers. I used an Apple II with Apple integer BASIC.

TIME TRIALS

You will use a single paddle controller to move a dot all over your TV screen in exactly the same way you would use your car's steering wheel to drive all over the countryside. This game places a race track on the screen. You must use the paddle controller to steer a dot, your "car," around the race track without hitting any obstacles or the sides of the track.

A clock is always running. If you hit something, the clock continues to run and you start over. If you reach the finish line and if your time is shorter than all previous runs, then you have established a new lap time. New players or experienced drivers will always have a new goal to shoot for. I was able to run the hard track in a count of 285 after considerable practice.

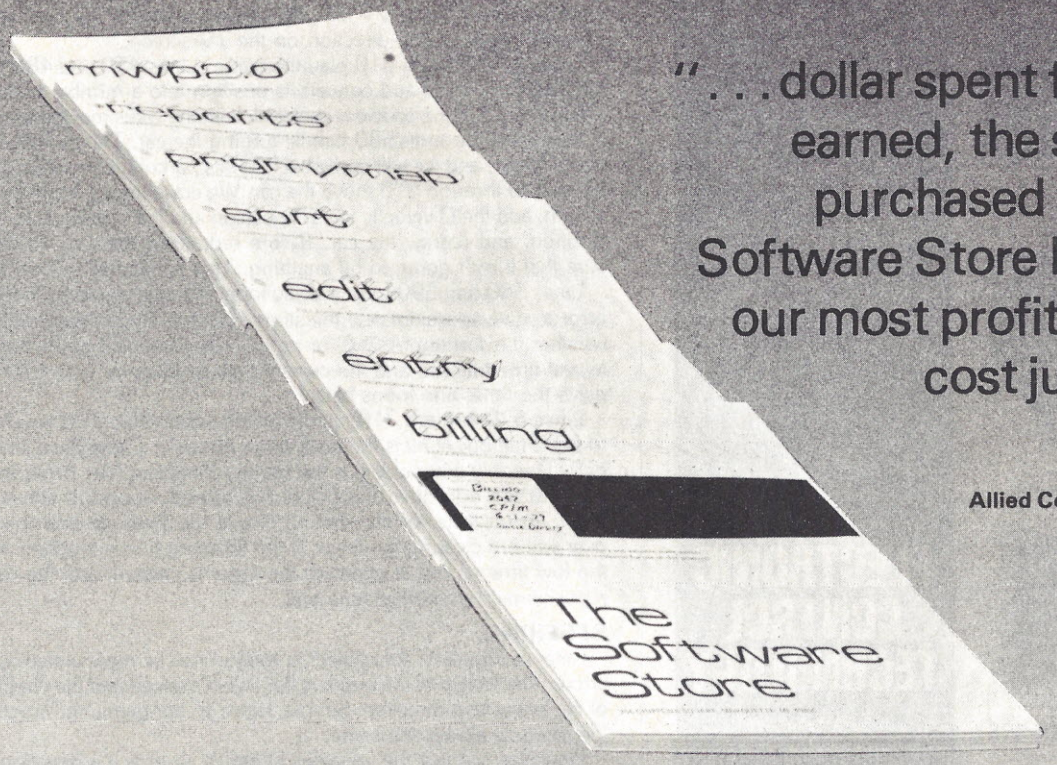
The game has two levels of difficulty: easy and hard. The program accepts the user's choice in lines 70 through 100. In line 70 we offer him his choices and in line 80 the keyboard is read. Since there is nothing else to do, the program waits for him to press a key. Once a key is pressed, line 90 clears the keyboard. Line 100 makes sure that the player has picked a valid choice. Otherwise, the program ignores his "advice" and waits for another key press.

What I have just given you is an excellent method for babyproofing your games. Tell the user exactly what his choices are, don't require the pressing of the RETURN key, and verify that only valid responses have been entered.

Lines 130 through 220 set up the race track and lines 260 through 350 set up the obstacles for the hard version. You can change these lines to make the game easier or harder as your driving skills change. Lines 390 and 400 draw the Starting/finishing line. Line 410 clears the timer and low score record.

Lines 420 and 430 set up the current location of your car and its initial velocity. The Apple screen area is 40 positions across and 40 positions up and down. I wanted to compute all screen locations down to one-fiftieth of a screen position. This gives a screen size of 2000 x 2000. The program maintains the car's position on this 2000 x 2000 position plane and divides both coordinates by 50 to obtain the car's actual plot location. This gives the car a nice smooth motion. The variable X refers to the car's horizontal position and the variable Y refers to the car's vertical position.

The variable U refers to the car's horizontal speed. If U=50 then the car will move one position to the right each count. If U=-50



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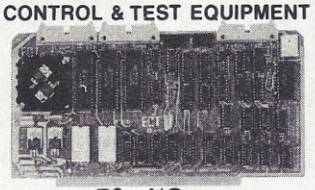

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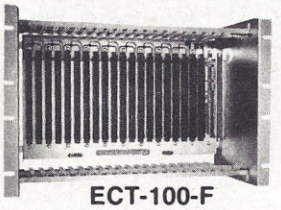

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then the car will move one position to the left. The variable V refers to the car's vertical speed. If V=50, the car is moving down one position each count. If V=-50 then the car is moving up the same amount. The car would move up and to the left one space every two counts if U=-25 and V=-25. By varying U and V the car can be made to move in any direction on the TV screen.

Lines 470 through 610 play the game. Lines 470 and 480 read paddle controller 0 and convert its position into a number between -10 and +10. If the paddle is centered, then the car is moving straight.

Lines 490 through 530 handle turning the car. This is the secret of the game, and we will come back to this part of the program later. Lines 540 through 570 move the car. We erase the car from the TV screen, add the U velocity to its X position and the V velocity to its Y position, and redraw the car. Before redrawing the car, we make sure that it isn't going to hit anything. This is handled in line 560.

Lines 580 and 590 form a delay loop. It is computed by trial and error to give approximately the same speed to the car regardless of whether it is turning (A<>0) or not (A=0). Line 600 prints out the lowest time trial run and the current time of this run. Line 610 updates the timer and loops back.

Lines 670 through 710 handle hitting something. First we check to see if the object hit is the track or an obstacle. These have a color of 9. The only other object is the starting/finishing line. If this line is hit from the right then the player has turned around. If either the track, an obstacle, or the starting line is touched, we start the car over without clearing the timer. If the finishing line is touched, then the low time record is updated, the timer is cleared, and the car is repositioned for another time trial.

STEERING

Refer to Figure 1. Any object in motion can be represented by an arrow. The length of the arrow is the object's speed and the direction of the arrow is its direction. Simple, right? In our game, the length of the arrow is always the same.

However, we use the variables U and V to give it a direction. In the figure, we show the car moving in the direction of the heavy arrow. In this case U=40 and V=-10.

We turn the car by turning the arrow. We have already said that lines 470 and 480 of the program convert the position of the paddle

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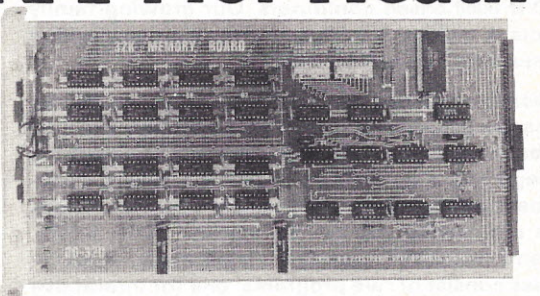

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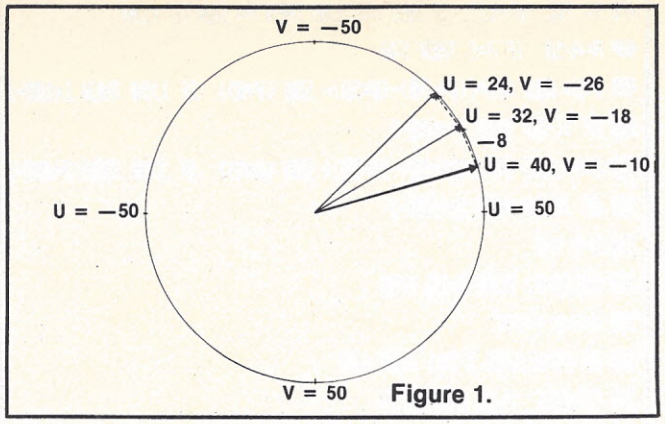

Figure 1.

controller into a number between -10 and +10. Suppose the number is -8. As long as this continues, every time we loop through the program the arrow will be shoved 8 units counter-clockwise. This will cause the car to move in a circle. After the first time, the car will be moving in direction (U=32, V=-18) and after the second time, the car will be moving in the direction (U=24, V=-26) and so forth.

Once the car is moving in the desired direction, center the paddle controller. The car will stop turning and begin moving in a straight line again — *but* in the new direction!

Lines 490 and 500 take the current U value of the arrow, compute the new U value and place it in the variable I. Lines 510 and 520 take the current value of the arrow and compute the new V value. This value is placed in J. Finally, line 530 updates both U and V.

If you don't know trigonometry or vector algebra, skip this paragraph. If you do, I heard your scream of foul play. You are correct. I did cheat. I am not adding my vectors together correctly and the values of U and V do not trace a circle. However, this is a good engineering approximation. It works, it's fast, and it is reasonably simple.

One final comment. The easiest way to steer the car is to place a piece of masking tape in the center of the paddle control knob. Turn the knob until the car is moving in a straight line. Draw a horizontal line on the tape. Now your controller looks like a steering wheel and it should be much easier to drive your car. Have fun.[]

Contact the author at Al Baker's Game Corner, P.O. Box 1234, Cerritos, CA 90701.

```
]PR#0
]LIST
  10 REM  TIME TRIALS
  20 REM
  30 TEXT : CALL -936
  40 REM
  50 REM  SET DIFFICULTY
  60 REM
  70 PRINT "EASY OR HARD (E,H):"
  80 A= PEEK (-16384): IF A<128 THEN 80
  90 POKE -16368,0
 100 IF (A<> ASC("E"))*(A<> ASC("H")) THEN 80
 110 REM
 120 REM  SET UP TRACK
 130 GR
 140 COLOR=9
 150 HLIN 0,39 AT 0
 160 HLIN 0,39 AT 39
 170 HLIN 8,31 AT 8
 180 HLIN 8,31 AT 31
 190 VLIN 0,39 AT 0
 200 VLIN 0,39 AT 39
 210 VLIN 8,31 AT 8
```


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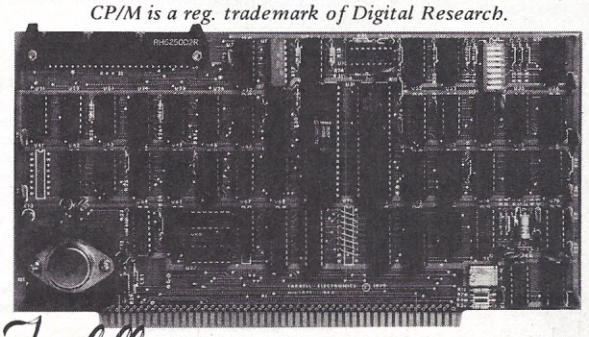

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CIRCLE INQUIRY NO. 97

```
220 VLIN 0,31 AT 31
230 REM
240 REM  SET UP BARRIERS
250 REM
260 IF A= ASC("E") THEN 390
270 VLIN 5,8 AT 19
280 HLIN 5,8 AT 19
290 HLIN 31,34 AT 19
300 VLIN 0,3 AT 13
310 HLIN 0,3 AT 13
320 VLIN 0,3 AT 25
330 HLIN 0,3 AT 25
340 HLIN 36,39 AT 13
350 HLIN 36,39 AT 25
360 REM
370 REM  INITIALIZE GAME VALUES
380 REM
390 COLOR=11
400 VLIN 32,38 AT 19
410 T=0:L=0
420 X=1000:Y=1000
430 U=50:V=0: COLOR=6: PLOT X/50,Y/50
440 REM
450 REM  HERE IS THE TIGHT GAME LOOP
460 REM
470 A= PDL (0)-127: IF ABS (A)>100 THEN A= SGN (A)*100
480 A=A/10: IF A=0 THEN 540
490 I=U+ ABS (A)*((U=-50)-(U=50)- SGN (V*A)): IF I>50 THEN I=100-I
500 IF I<-50 THEN I=-100-I
510 J=V+ ABS (A)*((V=-50)-(V=50)+ SGN (U*A)): IF J>50 THEN J=100-J
520 IF J<-50 THEN J=-100-J
530 U=I:V=J
540 COLOR=0: PLOT X/50,Y/50
550 X=X+U:Y=Y+V
560 IF SCRN(X/50,Y/50) THEN 670
570 COLOR=6: PLOT X/50,Y/50
580 A=10+30*(A=0)
590 FOR I=0 TO A: NEXT I
600 VTAB 22: PRINT "PREVIOUS LOW=";L,"TIME=";T
610 T=T+1: GOTO 470
620 REM
630 REM  WE HAVE HIT SOMETHING
640 REM  IF TRACK OR STARTING LINE, TRY AGAIN
650 REM  OTHERWISE, PLAYER SUCCEEDED IN REACHING FINISH LINE
660 REM
670 IF ( SCRN(X/50,Y/50)=9)+(U<0) THEN 420
680 IF (L=0)+(L>T) THEN L=T
690 T=0
700 PRINT : PRINT : PRINT : PRINT
710 GOTO 420
```


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• INVOICE AGING
• CHECK PRINTING WITH INVOICE DETAIL

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Not billed
Open and Closed Invoices
Aging Analysis
Customer Statements
Customer Activity List

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This system maintains vendor activity, automatically posts accounts payable and cash accounts, and will interface with a future mailing list program.
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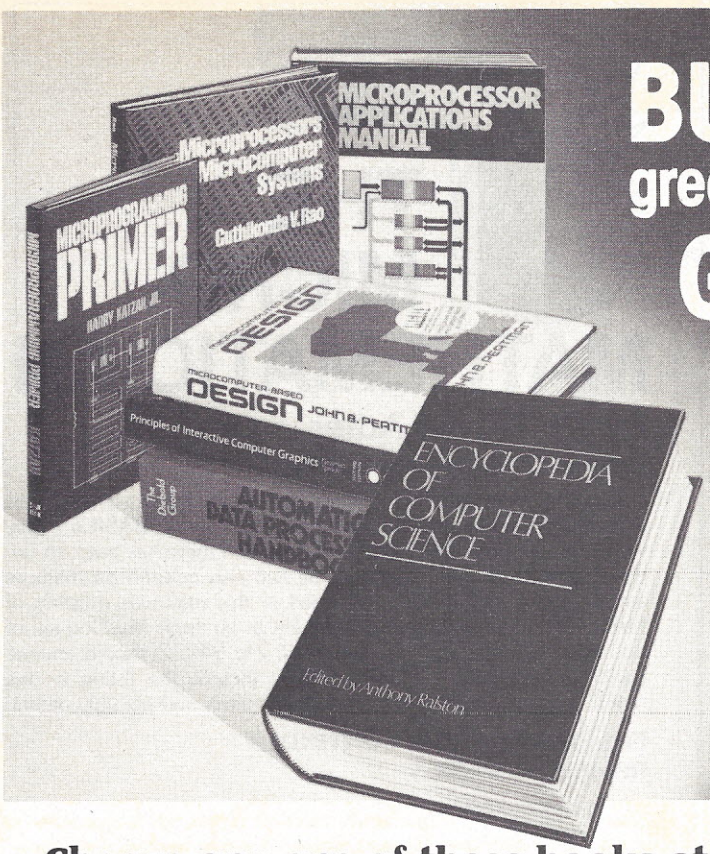

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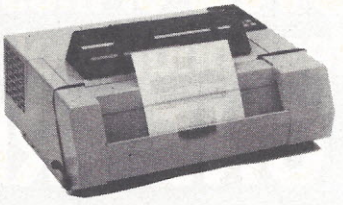

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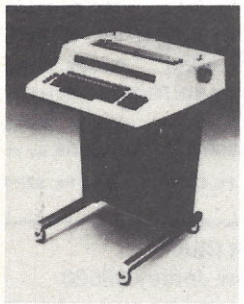

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THE MICRO-MATHEMATICIAN

By Dr. Alfred Adler

Program MATDEMO in Applesoft

In last month's column I promised to present listings of programs from this column that readers had converted to other BASICs, if they were of sufficiently broad appeal. Since then there has been an unusual amount of mail regarding the two part column on matrices and Program MATDEMO. Included in this mail was a listing of MATDEMO in Applesoft BASIC, sent in by John MacDougall of Los Altos, CA (110 N. Gordon Way, Zip 94022 should anyone want to contact him). I am happy to include the listing in this month's column for the benefit of Apple users and possibly others.

FOURIER ANALYSIS CONTINUED
REVIEW OF PART 1

Last month I addressed the problem of analyzing quasiperiodic functions and tentatively selected Fourier series as the most promising tool. We learned that an arbitrary periodic function can be represented as accurately as desired by a Fourier series, and that the Fourier coefficients can be easily determined by use of the Euler formulas.

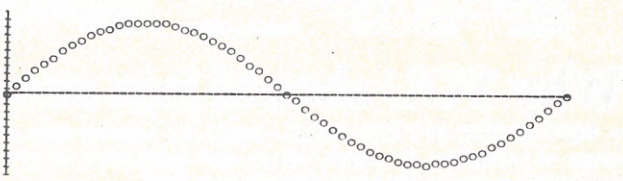
Conversely, knowing the values of the Fourier coefficients, it is possible to reproduce or synthesize the original function, and that, in general, the more of the coefficients we have evaluated, the more accurately we can reproduce the original function.

Various types of symmetry were discussed and a number of examples of simple periodic wave forms were examined. This month I will present Program 4YESERES, and use it to analyze and synthesize the

```
IF YOU WANT INSTRUCTIONS, RUN 1500.

Choose sinusoid, square, or triangle (1, 2, or 3): 1
State phase shift desired, in degrees: 0
What is the desired period? 60
What time increment will be used? 1
How many terms in Fourier series? 5

*********  INPUT DATA - TO BE SYNTHESIZED  *********
------ This curve is defined to be ONE PERIOD ------
```



```
 N          A(N)                B(N)
 0       .00000006           .00000000
 1       .00000002          1.00000000
 2       .00000006           .00000003
 3       .00000003           .00000002
 4       .00000006           .00000007
 5       .00000003           .00000002

######  OUTPUT DATA - SYNTHESIS OF INPUT DATA  ######
```

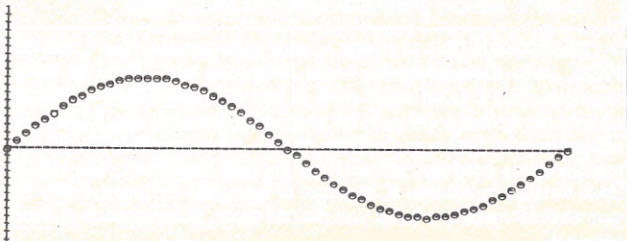


Figure 1.

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Is source code included?	YES, INCLUDING PROGRAM FLOWCHARTS.	YES	YES	NO
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effects of varying the wave sampling rate on the accuracy of the Fourier coefficients, and the effects of the sampling rate and the number of terms in the Fourier series on the accuracy of the synthesis.

```
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Choose sinusoid, square, or triangle (1, 2, or 3): 1
State phase shift desired, in degrees: 0
What is the desired period? 60
What time increment will be used? 5
How many terms in Fourier series? 5

*********  INPUT DATA - TO BE SYNTHESIZED  *********
------ This curve is defined to be ONE PERIOD ------
```
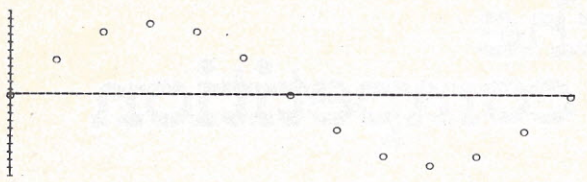



N	A(N)	B(N)
0	-.00000001	.00000000
1	.00000001	1.00000000
2	-.00000002	.00000001
3	.00000001	-.00000007
4	.00000019	.00000019
5	.00000025	.00000006

```
######  OUTPUT DATA - SYNTHESIS OF INPUT DATA  ######
```

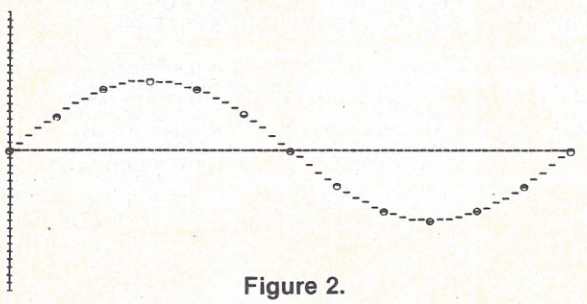
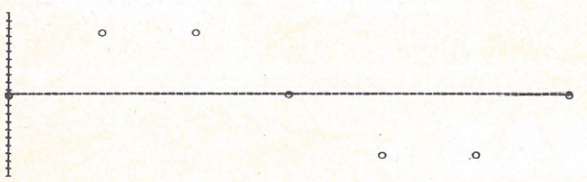


Figure 2.

```
IF YOU WANT INSTRUCTIONS, RUN 1500.

Choose sinusoid, square, or triangle (1, 2, or 3): 1
State phase shift desired, in degrees: 0
What is the desired period? 60
What time increment will be used? 10
How many terms in Fourier series? 5

*********  INPUT DATA - TO BE SYNTHESIZED  *********
------ This curve is defined to be ONE PERIOD ------
```



N	A(N)	B(N)
0	-.00000000	.00000000
1	-.00000001	1.00000000
2	.00000000	.00000009
3	.00000002	-.00000020
4	.00000046	.00000006
5	.00000045	-1.00000010

```
######  OUTPUT DATA - SYNTHESIS OF INPUT DATA  ######
```

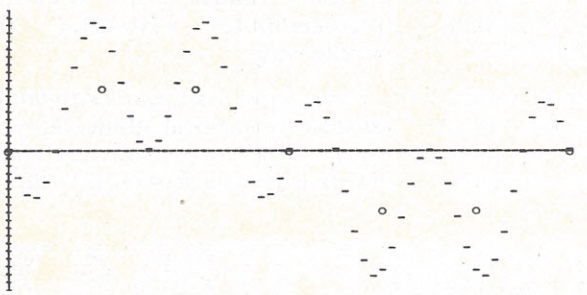


Figure 3.

PROGRAM 4YESERES

Program 4YESERES is specifically designed as a training aid. It contains a built in sinusoid, a square wave, and a triangle. These can be phase shifted, the assumed period can be adjusted (more on that later), the time increment at which the input wave is sampled is adjustable, and the number of terms in the Fourier series can be chosen by the user. These features were added to the program to permit a study of the effects of varying each of these parameters on our ability to accurately analyze and reproduce the original wave form.

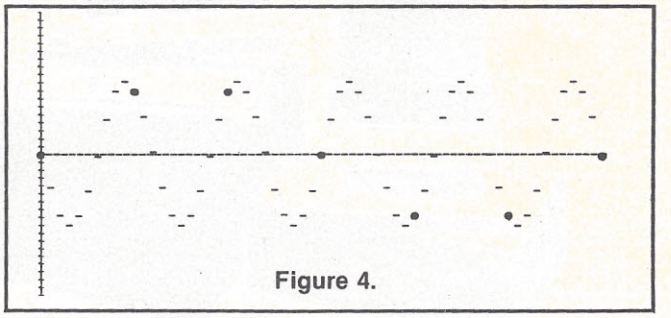


Figure 4.

When 4YESERES is RUN, the user is asked to choose the input wave form, the phase shift desired if any, the assumed period, the wave sampling rate, and the number of terms to be included in the Fourier series. The program then plots the input wave. Following this the Euler formulas are used to determine the Fourier coefficients, which are then presented. These Fourier coefficients are then used to reconstruct, or synthesize the input wave.

This synthesized input wave, which we now refer to as the output wave, is then plotted, and the input wave is overlaid for comparison. Program 4YESERES thus first analyzes the input wave, and then uses the resulting Fourier coefficients to synthesize it.

Referring to the listing, the built in functions of time are in statement numbers 186 to 240; the calculation of the Fourier coefficients is done in statement numbers 320 to 470; the plotting is done in statement numbers 540 to 1205; and instructions are available in statement numbers 1500 to 1630.

At this point a discussion of the plotting routine would probably be in order. I am fortunate enough to have a HyType I along with the software necessary to drive it as a plotter. For the sake of generality in the programs I normally do any required plotting using only the ordinary printer capability. This, of course, limits the resolution to 6 by 10 to the inch or thereabouts. Usually this is adequate. In the present case, however, the desired plots would be full page size and in some cases two pages long. I have therefore broken precedent and am using the full 48 by 60 to the inch capability of the HyType.

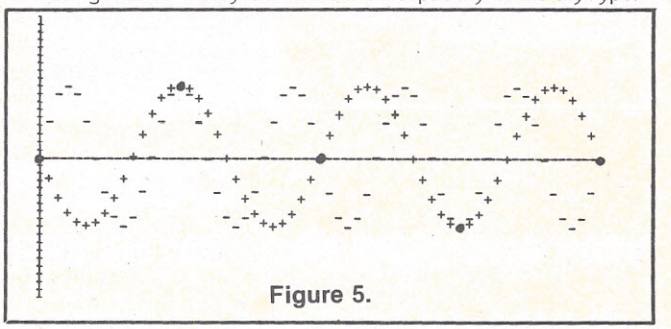


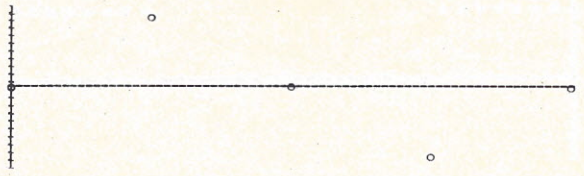
Figure 5.

Referring again to the listing, statement numbers 545 to 570 connect the FILL (POKE) and CALL variables to the printer driver; 585 to 630 plots the horizontal or X axis for the input data; and 630 to 680 plots the vertical or Y axis for the input data. This occurs when K = 0. Subroutines 695 and 730 separate the X and Y coordinate to be plotted into the most significant byte and the least significant byte and FILLs (POKEs) the proper addresses with these values.

The driver thinks that the origin is in the upper left hand corner of the plotting field and that X is positive to the right and Y is positive downward. Moreover, it will accept no negative values. This is really no problem. Regardless of how the data is plotted there is always a need for selecting the field and scaling the data. In this case the field is preselected and the data must not only be scaled but also shifted. Data scaling and shifting can be observed in statement numbers 780, 790, 1180, and 1193.

Continuing with the plotting routine, statement numbers 765 to 805 compute, scale and plot the input data. Statement numbers

```
IF YOU WANT INSTRUCTIONS, RUN 1500.

Choose sinusoid, square, or triangle (1, 2, or 3): 1
State phase shift desired, in degrees: 0
What is the desired period? 60
What time increment will be used? 15
How many terms in Fourier series? 2

*********  INPUT DATA - TO BE SYNTHESIZED  *********
------ This curve is defined to be ONE PERIOD ------
```



```
 N          A(N)                    B(N)
 0      -.00000000               .00000000
 1       .00000005              1.00000000
 2      -.00000000               .00000010

######  OUTPUT DATA - SYNTHESIS OF INPUT DATA  ######
```

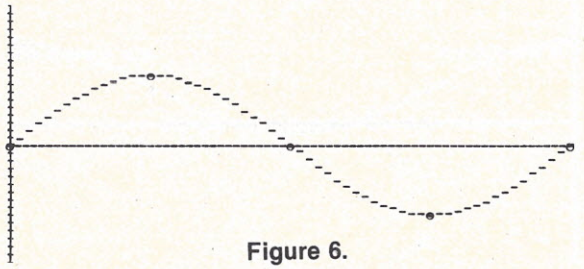
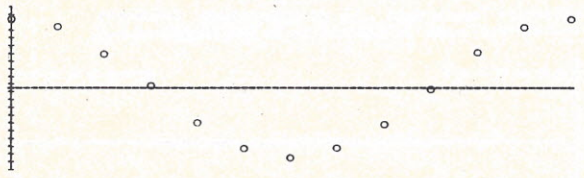


Figure 6.

807 to 830 shift the printing field clear of the plotting field so that the Fourier coefficients do not overprint the input data plot. So far, the value of K has not changed; K = 0. Following the printing of the Fourier coefficients, the output data is plotted.

The program at this point sets K = 1 and returns to statement numbers 585 to 680 to plot the X and Y axes for the output data. Statement numbers 1165 to 1205 then compute, scale, and plot the output data. Control then returns to statement numbers 756 to 805, where the input data is overlaid on the output data for comparison. Statement number 812 then computes the number of lines to be skipped, as a function of the number of Fourier coefficients printed, so that paging occurs properly.

```
IF YOU WANT INSTRUCTIONS, RUN 1500.

Choose sinusoid, square, or triangle (1, 2, or 3): 1
State phase shift desired, in degrees: 90
What is the desired period? 60
What time increment will be used? 5
How many terms in Fourier series? 5

*********  INPUT DATA - TO BE SYNTHESIZED  *********
------ This curve is defined to be ONE PERIOD ------
```



```
 N          A(N)                    B(N)
 0       .00000002               .00000000
 1      1.00000000               .00000001
 2       .00000012               .00000001
 3       .00000009               .00000009
 4       .00000007              -.00000011
 5       .00000004               .00000018

######  OUTPUT DATA - SYNTHESIS OF INPUT DATA  ######
```

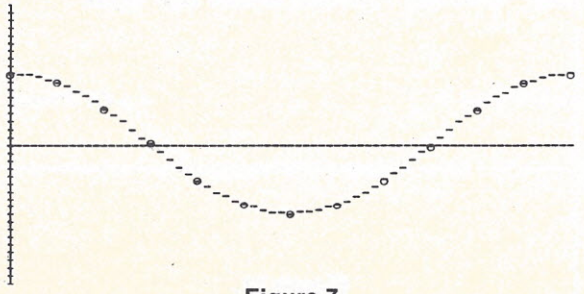


Figure 7.

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```
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Choose sinusoid, square, or triangle (1, 2, or 3): 1
State phase shift desired, in degrees: 30
What is the desired period? 60
What time increment will be used? 5
How many terms in Fourier series? 5

*********  INPUT DATA - TO BE SYNTHESIZED  *********
------ This curve is defined to be ONE PERIOD ------
```
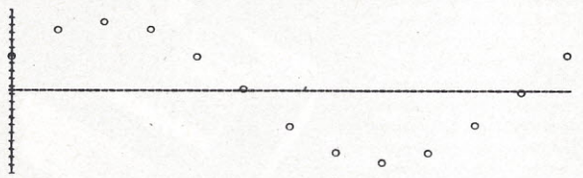



N	A(N)	B(N)
0	-.00000001	.00000000
1	.50000002	.86602542
2	.00000005	.00000004
3	.00000006	-.00000004
4	.00000019	.00000011
5	.00000026	.00000013

```
######  OUTPUT DATA - SYNTHESIS OF INPUT DATA  ######
```

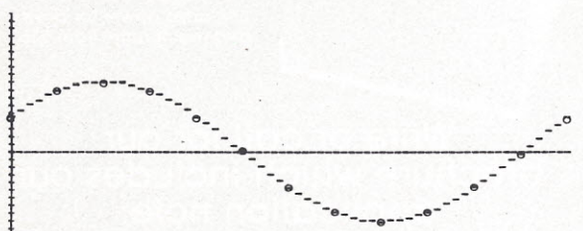
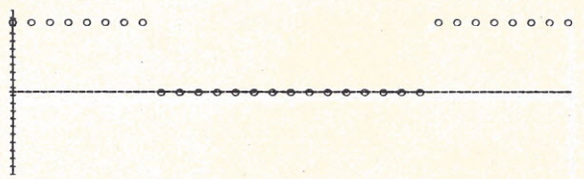


Figure 8.

```
IF YOU WANT INSTRUCTIONS, RUN 1500.

Choose sinusoid, square, or triangle (1, 2, or 3): 2
State phase shift desired, in degrees: 0
What is the desired period? 60
What time increment will be used? 2
How many terms in Fourier series? 1

*********  INPUT DATA - TO BE SYNTHESIZED  *********
------ This curve is defined to be ONE PERIOD ------
```



N	A(N)	B(N)
0	1.00000000	.00000000
1	.63778480	.00000000

```
######  OUTPUT DATA - SYNTHESIS OF INPUT DATA  ######
```

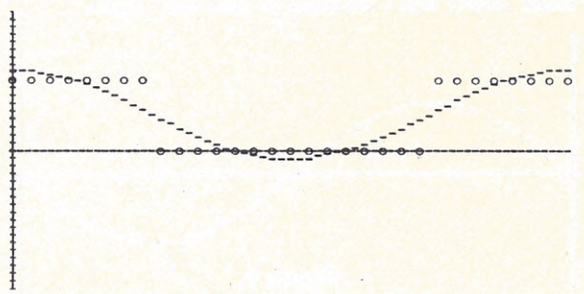


Figure 10.

SINUSOIDS — EFFECTS OF DISCRETE SAMPLING

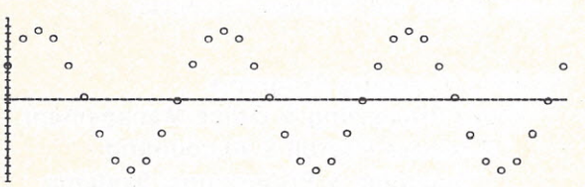
Now let us use the program to analyze and synthesize the simple wave forms discussed last month and attempt to determine the effects of varying some of the input parameters. First of all recall that all input waves have a period of 60 seconds, and an amplitude, A, of 1. During our experimenting we will assume various values for the period, but it is in fact 60 seconds. Any multiple of 60 seconds can, of course, also be considered the period.

The simplest function we will consider is a pure sine wave. Let us assume that the period is 60 seconds; that the wave is sampled every second; and that we desire 5 terms in the Fourier series, see Figure 1. As expected, $b_1 = 1$, and all the other b_n and all the a_n are very close to zero. If we now sample this wave every 5 seconds, we get no decrease in accuracy (except for the random numerical noise introduced by the computer).

Further reduction in the sampling rate causes no reduction in the accuracy of the coefficients until suddenly a very large error is introduced, see b_5 in Figure 3. The reason for this can be seen by a careful examination of the Fourier series representation of f(t).

$$f(t) = \frac{a_o}{2} + \sum_{n=1}^{n=\infty} [a_n \cos(2\pi nt/T) + b_n \sin(2\pi nt/T)]$$

```
IF YOU WANT INSTRUCTIONS, RUN 1500.

Choose sinusoid, square, or triangle (1, 2, or 3): 1
State phase shift desired, in degrees: 30
What is the desired period? 180
What time increment will be used? 5
How many terms in Fourier series? 5

*********  INPUT DATA - TO BE SYNTHESIZED  *********
------ This curve is defined to be ONE PERIOD ------
```



N	A(N)	B(N)
0	-.00000000	.00000000
1	.00000000	.00000002
2	.00000001	-.00000003
3	.50000019	.86602539
4	-.00000006	-.00000004
5	.00000009	-.00000001

```
######  OUTPUT DATA - SYNTHESIS OF INPUT DATA  ######
```

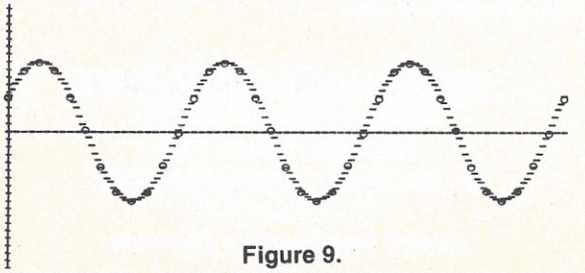
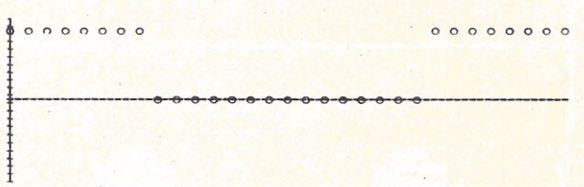


Figure 9.

```
IF YOU WANT INSTRUCTIONS, RUN 1500.

Choose sinusoid, square, or triangle (1, 2, or 3): 2
State phase shift desired, in degrees: 0
What is the desired period? 60
What time increment will be used? 2
How many terms in Fourier series? 3

*********  INPUT DATA - TO BE SYNTHESIZED  *********
------ This curve is defined to be ONE PERIOD ------
```



N	A(N)	B(N)
0	1.00000000	.00000000
1	.63778480	.00000000
2	.00000003	-.00000001
3	-.21573798	-.00000000

```
######  OUTPUT DATA - SYNTHESIS OF INPUT DATA  ######
```

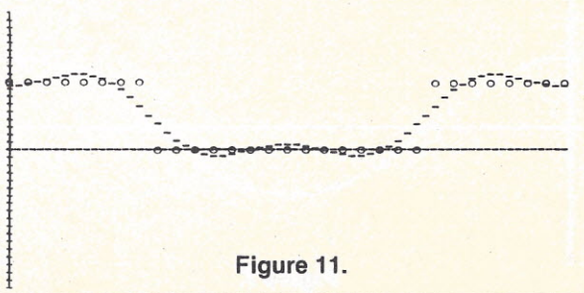


Figure 11.

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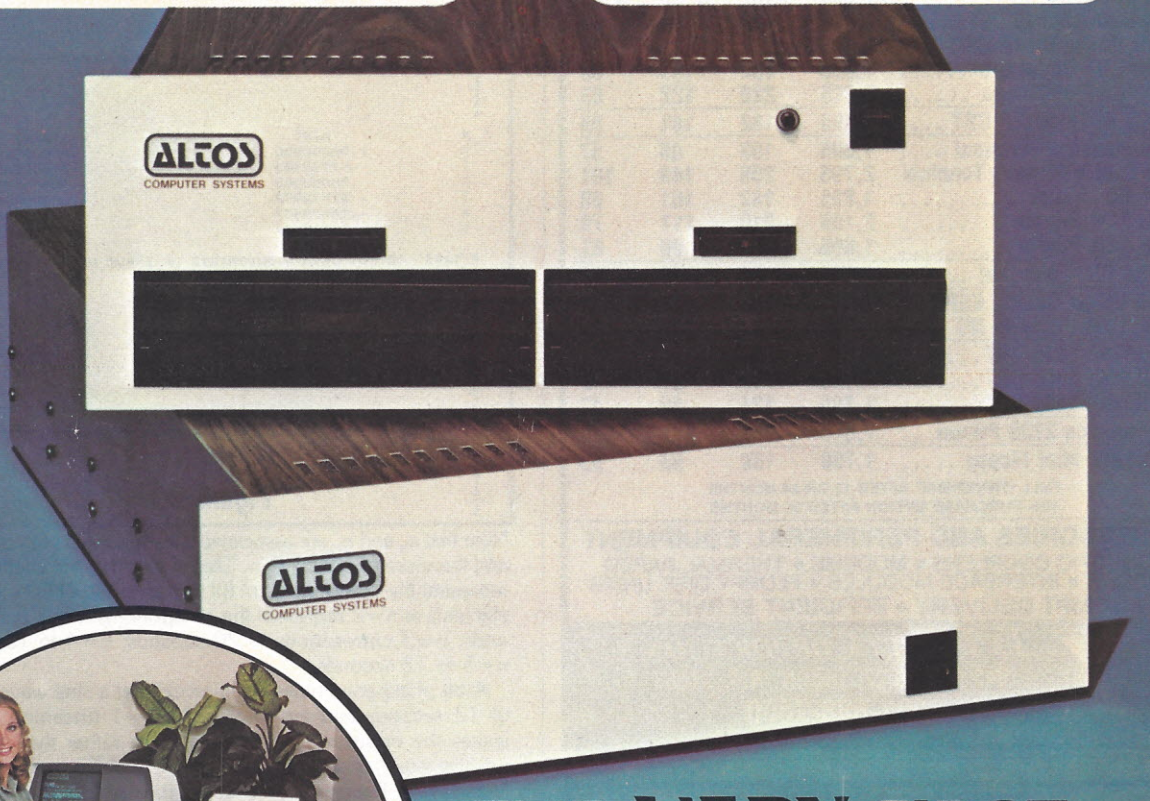

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TI825 KSR Printer	1,695	162	90	61
ADM3A CRT Terminal	875	84	47	32
QUME Letter Quality KSR	3,195	306	170	115
QUME Letter Quality RO	2,795	268	149	101
HAZELTINE 1410 CRT	875	84	47	32
HAZELTINE 1500 CRT	1,195	115	64	43
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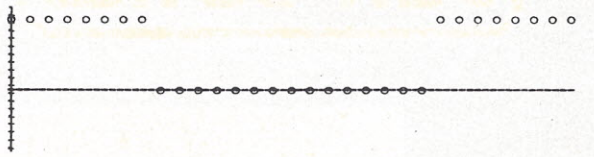
```
IF YOU WANT INSTRUCTIONS, RUN 1500.

Choose sinusoid, square, or triangle (1, 2, or 3): 2
State phase shift desired, in degrees: 0
What is the desired period? 60
What time increment will be used? 2
How many terms in Fourier series? 5

*********  INPUT DATA - TO BE SYNTHESIZED  *********
------ This curve is defined to be ONE PERIOD ------
```



```
 N          A(N)                    B(N)
 0     1.00000000               .00000000
 1      .63778480               .00000000
 2      .00000003              -.00000001
 3     -.21573798              -.00000000
 4     -.00000007               .00000006
 5      .13333324               .00000002

######  OUTPUT DATA - SYNTHESIS OF INPUT DATA  ######
```

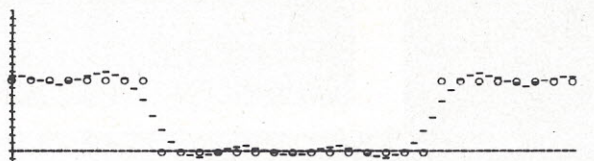


Figure 12.

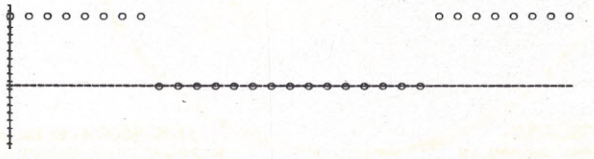
Note that a_n and b_n are associated with sinusoids of frequency $2\pi n/T$, and therefore of period T/n. This means that the coefficients at $n=1$ represent the components of f(t) with a period of 60 seconds; the coefficients at $n=2$ represent the components with a period of 30 seconds; $n=3$ corresponds to 20 seconds; $n=4$ to 15 seconds; and $n=5$ to 12 seconds.

A bit of experimentation will reveal that a sine wave with a period of 12 seconds and an amplitude of -1 (meaning that the wave leaves the origin with a negative slope rather than the customary positive slope), exactly fits the input data of Figure 3. A sketch of this is shown in Figure 4. The output data of Figure 3 is the result of combining the wave shown in Figure 4 with the sine wave repre-

```
IF YOU WANT INSTRUCTIONS, RUN 1500.

Choose sinusoid, square, or triangle (1, 2, or 3): 2
State phase shift desired, in degrees: 0
What is the desired period? 60
What time increment will be used? 2
How many terms in Fourier series? 15

*********  INPUT DATA - TO BE SYNTHESIZED  *********
------ This curve is defined to be ONE PERIOD ------
```



```
 N          A(N)                    B(N)
 0     1.00000000               .00000000
 1      .63778480               .00000000
 2      .00000003              -.00000001
 3     -.21573798              -.00000000
 4     -.00000007               .00000006
 5      .13333324               .00000002
 6      .00000011               .00000003
 7     -.09963181               .00000000
 8      .00000013               .00000007
 9      .08240438              -.00000001
10     -.00000005              -.00000003
11     -.07297574               .00000012
12      .00000008              -.00000013
13      .06815610              -.00000004
14     -.00000009              -.00000008
15     -.06666667               .00000009

######  OUTPUT DATA - SYNTHESIS OF INPUT DATA  ######
```

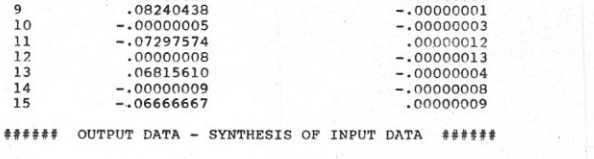
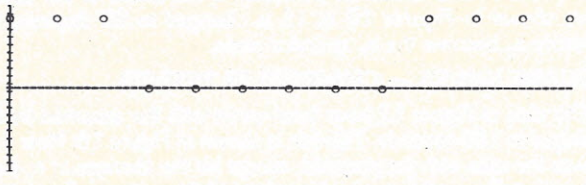


Figure 13.

```
IF YOU WANT INSTRUCTIONS, RUN 1500.

Choose sinusoid, square, or triangle (1, 2, or 3): 2
State phase shift desired, in degrees: 0
What is the desired period? 60
What time increment will be used? 5
How many terms in Fourier series? 5

*********  INPUT DATA - TO BE SYNTHESIZED  *********
------ This curve is defined to be ONE PERIOD ------
```



N	A(N)	B(N)
0	1.00000000	.00000000
1	.62200847	-.16666667
2	.00000010	.00000003
3	-.16666658	.16666680
4	-.00000003	-.00000024
5	.04465804	-.16666659

```
######  OUTPUT DATA - SYNTHESIS OF INPUT DATA  ######
```

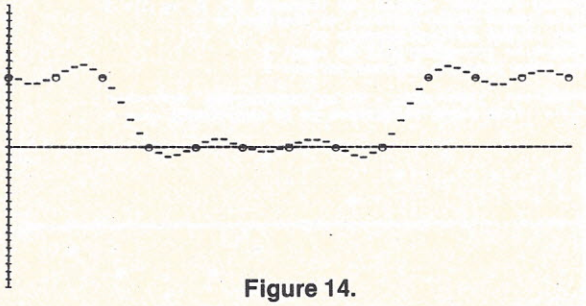


Figure 14.

sented by b_1 in Figure 3, that is, a wave with a period of 60 seconds and an amplitude of 1.

Although the large magnitude of coefficient b_5 might be regarded as an error, in actuality it is not. The Fourier analysis is simply doing its job, and picking up every possible component of the input wave. If the wave is sampled only every 15 seconds, we will find that not only b_5 but also b_3 has a magnitude of 1. This is because a sine wave with a period of 20 seconds and an amplitude of 1 also fits the input data, see Figure 5.

SINUSOIDS — NUMBER OF TERMS

In the beginning of this column I stated that the more terms that are carried in a Fourier series, the more accurately it represents f(t). This certainly appears to be contradicted by the latest turn of events, in which carrying the Fourier series out a bit further introduces undesired and seemingly erroneous terms.

The key to this apparent contradiction is in the definition of f(t). If f(t) is a continuous function, expressed analytically, then there is no question of the validity of the statement. However, when f(t) is discretely sampled, it is only defined at the sampling points, and is undefined, *repeat undefined,* in between.

It follows then that any wave of sufficiently high frequency (small enough period) that it can fit between the sampling points not only will be picked up by the Fourier analysis, but properly so. Or, in other words, the idea that the sample points shown in Figure 5 represent a sine wave period of 60 seconds, as opposed to one of 20 seconds or 12 seconds as drawn, or any one of an infinite number of other selected lesser periods, exists only in the mind of the user. As a perfect example of this, consider the question of whether the sample points in Figure 5 represent a sine wave, such as we have been discussing, in which case b_3 and b_5 should properly be zero, or a triangular wave, which we will be discussing shortly, in which case b_3 and b_5 should certainly not equal zero.

Even when f(t) is only sampled at 15 second intervals, it can be synthesized exactly from the resulting Fourier coefficients if the number of terms in the Fourier series is held below the number at which spurious higher frequency terms can enter, see Figure 6.

SINUSOIDS — PHASE CHANGES

We have seen that if f(t) is a sine wave and the chosen phase angle equals zero, see Figure 2, all the a_n equal zero and one of the b_n is nonzero. If the chosen phase angle is 90 degrees, then the sine wave becomes a cosine wave and all the b_n equal zero and one of the a_n is nonzero, see Figure 7.

If any other phase angle is selected, then for some value of n (see the next section), both a_n and b_n will be nonzero and all the other a_n and b_n will be zero, see Figure 8. This is because to represent a general phase angle both a sine and a cosine are required, as an examination of the equation for f(t), given above, will reveal.

SINUSOIDS — CHANGES IN PERIOD

It was stated earlier in this column that all input waves have a period of 60 seconds. The user is free to assume any value for the period but the actual period remains 60 seconds. If a period is assumed that is a multiple of 60 seconds, then instead of b_1, or a_1, or a combination thereof, being equal to 1, and all the others being equal to zero, the value of n at which the coefficient is nonzero will increase. For example, if a period of 180 seconds is assumed, then a_3, or b_3, or both will be nonzero.

In general, if the assumed period is m times 60, then the value of n at which the coefficients are nonzero is also m. This is illustrated in Figure 9, where the assumed period is 180 seconds. Note that the data in Figure 9 are a rerun of the data in Figure 8, except for the change in period. Note further that, except for the change in n, the nonzero Fourier coefficients are essentially unchanged by the change in period. The situation where the assumed period is not a multiple of 60 is considerably more complex and this case will be considered next month.

SQUARE WAVES — NUMBER OF TERMS

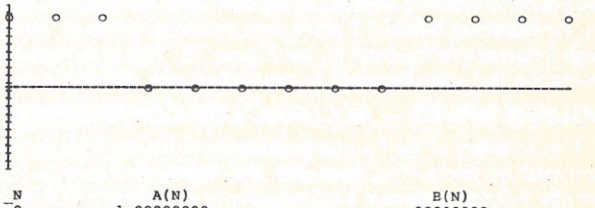
Analysis and synthesis of sinusoids is a gross oversimplification of the general problem, since sinusoids have at the most two nonzero Fourier coefficients. This, of course, is because Fourier series uses sinusoids themselves to do the synthesis. Square waves on the other hand require an infinite number of Fourier terms since the sharp corners cannot be reconstructed by anything less than a wave of infinitely high frequency (period vanishingly small).

Figures 10 to 13 show a square wave, phased so as to be an even function, and with an assumed period of 60 seconds. The wave is sampled at 2-second intervals, and in successive figures, 1, 3, 5, and 15 terms are used in the Fourier series. Note that when only one term is used, the synthesis results in a pure cosine wave. By now the reader should know that this is to be expected. As more

```
IF YOU WANT INSTRUCTIONS, RUN 1500.

Choose sinusoid, square, or triangle (1, 2, or 3): 2
State phase shift desired, in degrees: 0
What is the desired period? 60
What time increment will be used? 5
How many terms in Fourier series? 11

*********  INPUT DATA - TO BE SYNTHESIZED  *********
------ This curve is defined to be ONE PERIOD ------
```



N	A(N)	B(N)
0	1.00000000	.00000000
1	.62200847	-.16666667
2	.00000010	.00000003
3	-.16666658	.16666680
4	-.00000003	-.00000024
5	.04465804	-.16666659
6	.00000000	.00000009
7	.04465839	.16666680
8	.00000004	.00000002
9	-.16666635	-.16666668
10	.00000010	-.00000014
11	.62200872	.16666663

```
######  OUTPUT DATA - SYNTHESIS OF INPUT DATA  ######
```

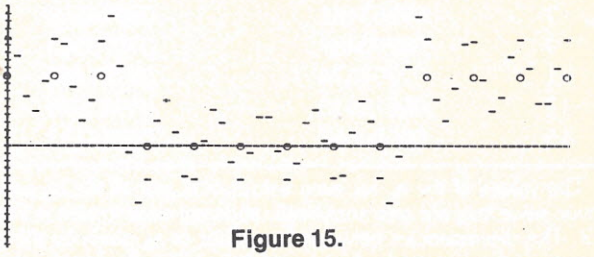
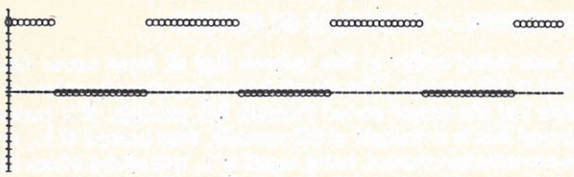


Figure 15.

```
...RUN 1500.

Choose sinusoid, square, or triangle (1, 2, or 3): 2
State phase shift desired, in degrees: 0
What is the desired period? 180
What time increment will be used? 2
How many terms in Fourier series? 15

*********  INPUT DATA - TO BE SYNTHESIZED  *********
------ This curve is defined to be ONE PERIOD ------
```



```
 N          A(N)                    B(N)
 0     1.00000000              .00000000
 1     -.00000000              .00000000
 2     -.00000003              .00000000
 3      .63778483              .00000001
 4     -.00000007              .00000001
 5      .00000001             -.00000000
 6     -.00000006             -.00000003
 7     -.00000001              .00000001
 8     -.00000002             -.00000003
 9     -.21573784             -.00000005
10     -.00000001              .00000007
11      .00000022             -.00000002
12     -.00000006             -.00000007
13      .00000006              .00000019
14      .00000025              .00000009
15      .13333311              .00000009

######  OUTPUT DATA - SYNTHESIS OF INPUT DATA  ######
```

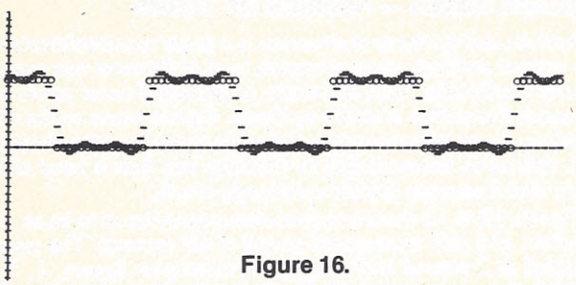


Figure 16.

terms are included in the Fourier series, the synthesis becomes more accurate, again as expected.

Of course, it is also to be expected that if sufficient terms are added to the Fourier series that the same thing will happen as happened with the sinusoids; that is, spurious high frequency terms will enter because the square wave is undefined between the sampling points.

To test this idea, several runs were made with sampling points only every 5 seconds. Sure enough, when only 5 terms were included in the Fourier series, everything was fairly normal, see Figure 14. Of course, the Fourier coefficients were not as accurate (note the nonzero values of b_1, for example). When 11 terms were included, however, incorrect high frequency terms crept in, see Figure 15. This is the same phenomenon that was discussed in connection with the sinusoids.

SQUARE WAVES — ACCURACY OF COEFFICIENTS

The accuracy of the Fourier coefficients in Figure 13 may be determined by comparing them with the analytical values given last month. For convenience, a comparison is presented in Table 1.

Table 1.

n	a_n from Figure 13	analytical values of a_n
0	1.00000000	1.00000000
1	.63778480	.63661977
3	−.21573798	−.21220659
5	.13333324	.12732395
7	−.09963181	−.09094568
9	.08240438	.07073553
11	−.07297574	−.05787452
13	.06815610	.04987075
15	−.06666667	−.04244132

The values of the a_n for even values of n and all the b_n are not given since they are zero analytically and very close to zero in Figure 13. The discrepancies between the values of a_n given by the program and the analytical values is due first of all to the fact that the input to the program is not an analytic function but rather a set of discrete sampling points. Additional error is undoubtedly introduced by the numerical integration procedure.

SQUARE WAVES — PHASE CHANGES

As is the case with sinusoids, and any other wave form for that matter, a change in phase simply disturbs the sine and cosine structure of the Fourier series. In particular, if the phase of the square wave shown in Figures 10 to 15 is changed to 90 degrees, the formerly a_n become the b_n and vice versa.

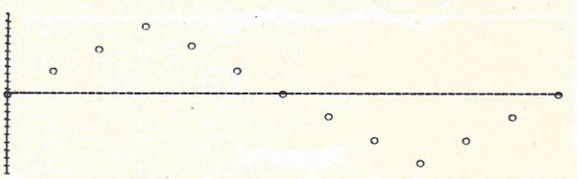
SQUARE WAVES — CHANGES IN PERIOD

The data of Figure 12 have been rerun with the assumed period changed to 180 seconds. This run is shown in Figure 16. Note that, as was the case with the sinusoid, except for the changes in n, there are essentially no changes in the values of the nonzero Fourier coefficients due to the change in period.

```
IF YOU WANT INSTRUCTIONS, RUN 1500.

Choose sinusoid, square, or triangle (1, 2, or 3): 3
State phase shift desired, in degrees: 0
What is the desired period? 60
What time increment will be used? 5
How many terms in Fourier series? 5

*********  INPUT DATA - TO BE SYNTHESIZED  *********
------ This curve is defined to be ONE PERIOD ------
```



```
 N          A(N)                    B(N)
 0      .00000000              .00000000
 1      .00000001              .82934465
 2      .00000001              .00000003
 3     -.00000001             -.11111122
 4      .00000015              .00000020
 5      .00000018              .05954426

######  OUTPUT DATA - SYNTHESIS OF INPUT DATA  ######
```

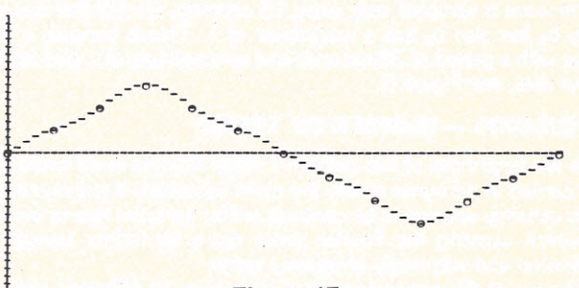


Figure 17.

TRIANGULAR WAVES

Everything that has been said about the effects of sampling rates and the number of terms in the Fourier series in connection with sinusoids and square waves applies also to triangular waves. Figure 17 is typical of what Program 4YESERES will do with a triangular wave input. A comparison of the pertinent Fourier coefficients from Figure 17 with the analytical values is shown in Table 2.

Table 2.

n	b_n from Figure 17	analytical values of b_n
1	.82934465	.81056947
3	−.11111122	−.09006327
5	.05954426	.03242278

The discrepancies between the values occur for the reasons discussed following Table 1.

Next month I will conclude this discussion of Fourier analysis by attempting to analyze real world quasi-periodic functions.□

Contact the author at Micro Mathematician, P.O. Box 1234, Cerritos, CA 90701.

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GRAPHIC-TREK "2000" — This full graphics, real time game is full of fast, exciting action! Exploding photon torpedoes and phasers fill the screen! You must actually navigate the enterprise to dock with the giant space stations as well as to avoid klingon torpedoes! Has shields, galactic memory readout, damage reports, long range sensors, etc! Has 3 levels for beginning, average, or expert players! ★ **INVASION WORG** — Time: 3099, Place: Earth's Solar System Mission: As general of Earth's forces, your job is to stop the Worg invasion and destroy their outposts on Mars, Venus, Saturn, Neptune, etc! Earth's Forces: Androids — Space Fighters — Lazer Cannon — Neutrino Blasters! Worg Forces: Robots — Saucers — Disintegrators — Proton Destroyers! Multi level game lets you advance to a more complicated game as you get better! ★ **STAR WARS** — Manuever your space fighter deep into the nucleus of the Death Star! Drop your bomb, then escape via the only exit. This graphics game is really fun! May the Force be with you! ★ **SPACE TARGET** — Shoot at enemy Ships with your missiles. If they eject in a parachute, capture them — or if you're cruel, destroy them! Full graphics, real time game! ★ **SAUCERS** — This fast action graphics game has a time limit! Can you be the commander to win the distinguished cross! Requires split second timing to win! Watch out!

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ **PACKAGE TWO** ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

CHECKERS 2.1 — Finally! A checkers program that will challenge everyone! Expert as well as amateur! Uses 3-ply tree search to find best possible move. Picks randomly between equal moves to assure you of never having identical games. ★ **POKER FACE** — The computer uses psychology as well as logic to try and beat you at poker. Cards are displayed using TRS-80's full graphics. Computer raises, calls, and sometimes even folds! Great practice for your Saturday night poker match! (Plays 5 card draw). ★ **PSYCHIC** — Tell the computer a little about yourself and he'll predict things about you, you won't believe! A real mind bender! Great amusement for parties. ★ **TANGLE MANIA** — Try and force your opponent into an immobile position. But watch out, they're doing the same to you! This graphics game is for 2 people and has been used to end stupid arguments. (And occasionally starts them!) ★ **WORD SCRAMBLE** — This game is for two or more people. One person inputs a word to the computer while the others look away. The computer scrambles the word, then keeps track of wrong guesses.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ **PACKAGE THREE** ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

POETRY — This program lets you choose the subject as well as the mood of the poem you want. You give TRS-80 certain nouns or names, then the mood, and it does the rest! It has a 1000-word + vocabulary of nouns, verbs, adjectives and adverbs! ★ **ELECTRIC ARTIST** — Manual: draw, erase, move as well as, Auto: draw, erase and move. Uses graphics bits not bytes. Saves drawing on tape or disk! ★ **GALACTIC BATTLE** — The Swineus enemy have long range phasers but cannot travel at warp speed! You can, but only have short range phasers! Can you blitzkrieg the enemy without getting destroyed! Full graphics — real time! ★ **WORD MANIA** — Can you guess the computer's words using your human intuitive and logical abilities? You'll need to, to beat the computer! ★ **AIR COMMAND** — Battle the Kamikaze pilots. Requires split second timing. This is a FAST action arcade game.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ **PACKAGE FOUR** ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

LIFE — This Z-80 machine language program uses full graphics! Over 100 generations per minute make it truly animated! You make your starting pattern, the computer does the rest! Program can be stopped and changes made! Watch it grow! ★ **SPACE LANDER** — This full graphics simulator lets you pick what planet, asteroid or moon you wish to land on! Has 3 skill levels that make it fun for everyone. ★ **GREED II** — Multi-level game is fun and challenging! Beat the computer at this dice game using your knowledge of odds and luck! Computer keeps track of his winnings and yours. Quick fast action. This game is not easy! ★ **THE PHARAOH** — Rule the ancient city of Alexandria! Buy or sell land. Keep your people from revolting! Stop the rampaging rats. Requires a true political personality to become good! ★ **ROBOT HUNTER** — A group of renegade robots have escaped and are spotted in an old ghost town on Mars! Your job as "Robot Hunter" is to destroy the pirate machines before they kill any more settlers! Exciting! Challenging! Full graphics!

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ **PACKAGE FIVE** ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

SUPER HORSERACE — Make your bets just like at the real racetrack! 8 horses race in this spectacular graphic display! Up to 9 people can play! Uses real odds but has that element of chance you see in real life! Keeps track of everyone's winnings and losses. This is one of the few computer simulations that can actually get a room of people cheering! ★ **MAZE MOUSE** — The mouse with a mind! The computer generates random mazes of whatever size you specify, then searches for a way out! The second time, he'll always go fastest route! A true display of artificial intelligence! Full graphics, mazes & mouses! ★ **AMOEBA KILLER** — You command a one man submarine that has been shrunken to the size of bacteria in this exciting graphic adventure! Injected into the president's bloodstream, your mission is to destroy the deadly amoeba infection ravaging his body! ★ **LOGIC** — This popular game is based on Mastermind but utilizes tactics that make it more exciting and challenging — has 2 levels of play to make it fun for everyone. ★ **SUBMARINER** — Shoot torpedoes at the enemy ships to get points. Fast action graphics, arcade type game is exciting and fun for everybody!

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ **PACKAGE SIX** ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

20 HOME FINANCIAL PROGRAMS — Figures amortization, annuities, depreciation rates, interest tables, earned interest on savings and much, much more. These programs will get used again and again. A must for the conscientious, inflation minded person.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ **PACKAGE SEVEN** ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

BACKGAMMON 5.0 — 2 different skill levels make this game a challenge to average or advanced players. (Not recommended for beginners). Looks for best possible move to beat you! FANTASTIC GRAPHICS. Plays doubles and uses international rules. ★ **SPEED READING** — Increases your reading speed. Also checks for comprehension of material. Great for teenagers and adults to improve reading skills. ★ **PT 109** — Drop depth charges on moving subs. Lower depths get higher points in this fast action graphics game. ★ **YAHTZEE** — Play Yahtzee with the computer. This popular game is even more fun and challenging against a TRS-80! ★ **WALL STREET** — Can you turn your $50,000 into a million dollars? That's the object of this great game. Simulates an actual stock market!

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PROGRAM LISTING

```
3  CLEAR : DIM A(10,10),B(10,10):R$ =  CHR$ (12):S$ = " "
4  DIM I1(10),J1(10)
5  TEXT : HOME
10  REM  MATDEMO--DEMONSTRATION PROGRAM FOR MATRIX MATHEMATICS
15  REM   ORIGINALLY WRITTEN BY REV'D WALTER L. PRAGNELL
20  REM  PUBLISHED BY DR. ALFRED ADLER IN INTERFACE AGE    OCT 1979
25  REM  ADAPTED FOR THE APPLE BY JOHN MACDOUGALL
26  REM  110 N. GORDON WAY, LOS ALTOS, CA94022
30  PRINT "MATRIX MATHEMATICS TUTORIAL"
32 T$(1) = "1.ADD TWO MATRICES":T$(2) = "2.MULTIPLY TWO MATRICES
33 T$(3) = "3.INVERT A MATRIX":T$(4) = "4.TRANSPOSE A MATRIX":T$(5) = "5.E
    XIT FROM THE PROGRAM"
40  FOR I = 1 TO 5
50  PRINT : HTAB 10: PRINT T$(I)
60  NEXT I
90  PRINT : PRINT : HTAB 5: INPUT "WHICH?-- ";Z9
100  IF Z9 < 1 OR Z9 > 5 THEN 90
102  IF Z9 = 5 THEN 5000
105  HOME : HTAB 10: PRINT T$(Z9)
110  PRINT R$,: ON Z9 GOTO 1000,2000,3000,4000,5000
1000  REM  ROUTINE TO ADD TWO MATRICES
1010  PRINT : PRINT "MATRIX DIMENSIONS (R,C)?-- ";:I = 1: GOSUB 6060:M = C
    (1,1):K = C(1,2)
1020  IF M < 1 OR M > 9 OR K < 1 OR M > 9 THEN  GOSUB 10000: GOTO 1010
1030 X = M:Y = K:D = M:E = K
1040  GOSUB 8000: GOSUB 8500
1050  PRINT : PRINT "SUM OF A(M,K) + B(M,K) = C(M,K):"
1060  FOR I = 1 TO M: FOR J = 1 TO K:C(I,J) = A(I,J) + B(I,J): NEXT : NEXT
    : PRINT
1070  GOSUB 7000
1080  GOTO 3
2000  REM  MULTIPLY TWO MATRICES
2010  PRINT : PRINT "MULTIPLY ONE MATRIX, A(M,K)"
2020  PRINT "BY ANOTHER ONE, B(K,N)"
2030  PRINT "TO GIVE A PRODUCT, C(M,N)"
2040  PRINT : PRINT "DIMENSIONS OF MATRIX A(M,K)?-- ";:
2050 I = 1: GOSUB 6060:M = C(1,1):K = C(1,2)
2060  IF M < 1 OR M > 9 OR K < 1 OR K > 9 THEN  GOSUB 10000: GOTO 2040
2070  PRINT "COLUMN DIMENSION OF MATRIX B(";K;",N)?-- ";
2080 I = 1: GOSUB 6060:N = C(1,1)
2085  IF N < 1 OR N > 9 THEN  GOSUB 10000: GOTO 2070
2090 X = M:Y = K
2100  GOSUB 8000
2110 X = K:Y = N
2130 D = K:E = N
2140  GOSUB 8500
2150  PRINT "PRODUCT OF A(M,K) X B(K,N)=C(M,N)"
2160  FOR I = 1 TO M: FOR J = 1 TO N:O = 0
2170  FOR H = 1 TO K:O = O + A(I,H) * B(H,J): NEXT
2180 C(I,J) = O
2190  NEXT : NEXT
2200 X = M:Y = N
2210  GOSUB 7000
2220  GOTO 3
3000  REM  MATRIX INVERSION
3010  INPUT "DEG. OF THE MATRIX?-- ";N
3020  IF N < 1 OR N > 9 THEN  GOSUB 10000: GOTO 3010
3030  PRINT : PRINT "ENTER THE MATRIX FOR INVERSION:"
3040 X = N:Y = N
3050  GOSUB 6000
3060  FOR I = 1 TO N: FOR J = 1 TO N
3070 A(I,J) = C(I,J)
3080  NEXT : NEXT
3090 D = 1: REM  START INVERSION
3100  FOR K = 1 TO N:M = 0
3110  FOR I = K TO N: FOR J = K TO N
3120  IF  ABS (M) >  ABS (A(I,J)) THEN 3140
3130 M = A(I,J):I1(K) = I:J1(K) = J
3140  NEXT : NEXT
3150  IF M <  > 0 THEN 3170
3160 D = 0: GOTO 3470
3170 I = I1(K)
3180  IF K > I THEN 3110
3185  IF K = I THEN 3200
3190  FOR J = 1 TO N:X = A(K,J):A(K,J) = A(I,J):A(I,J) =  - X: NEXT
3200 J = J1(K)
3210  IF K > J THEN 3110
3215  IF K = J THEN 3230
3220  FOR I = 1 TO N:X = A(I,K):A(I,K) = A(I,J):A(I,J) =  - X: NEXT
3230  FOR I = 1 TO N: REM  BUILD INVERSE
3240  IF K = I THEN 3260
3250 A(I,K) =  - A(I,K) / M
3260  NEXT
3270  FOR I = 1 TO N: FOR J = 1 TO N
3280  IF I = K THEN 3310
3290  IF J = K THEN 3310
3300 A(I,J) = A(I,J) + A(I,K) * A(K,J)
3310  NEXT : NEXT
3320  FOR J = 1 TO N
3330  IF J = K THEN 3350
3340 A(K,J) = A(K,J) / M
3350  NEXT
3360 A(K,K) = 1 / M
3370 D = D * M: REM  DETERMINANT
3380  NEXT
3390  FOR L = 1 TO N: REM  UNSCRAMBLE INVERSE
3400 K = N - L + 1:J = I1(K): IF K =  > J THEN 3420
3410  FOR I = 1 TO N:X = A(I,K):A(I,K) =  - A(I,J):A(I,J) = X: NEXT
3420 I = J1(K)
3430  IF K =  > I THEN 3450
3440  FOR J = 1 TO N:X = A(K,J):A(K,J) =  - A(I,J):A(I,J) = X: NEXT
3450  NEXT L
3460  IF D <  > 0 THEN 3480
3470  PRINT "DETERMINANT IS 0. NO INVERSE POSSIBLE.": GOTO 20000
3480  PRINT "DETERMINANT= ";D: PRINT : PRINT "INVERTED MATRIX:"
3485 X = N:Y = N
3490  FOR I = 1 TO N: FOR J = 1 TO N:C(I,J) = A(I,J): NEXT : NEXT
3495  GOSUB 7000
3500  GOTO 3
4000  REM  TRANSPOSE A MATRIX
4010  PRINT : PRINT "MATRIX DIMENSIONS (R,C)?-- ";:I = 1: GOSUB 6060:M = C
    (1,1):K = C(1,2)
4020  IF M < 1 OR M > 9 OR K < 1 OR K > 9 THEN  GOSUB 10000: GOTO 4010
4030 X = M:Y = K
4040  PRINT "ENTER THE MATRIX:": GOSUB 6000
4045  FOR I = 1 TO M: FOR J = 1 TO K:A(I,J) = C(I,J): NEXT : NEXT
4050  FOR I = 1 TO M: FOR J = 1 TO K:C(J,I) = A(I,J): NEXT : NEXT : PRINT

4060  PRINT : PRINT "TRANSPOSE OF MATRIX A(M,K)=C(K,M):"
4070 X = K:Y = M
4080  GOSUB 7000
```

```
4090  GOTO 3
5000  PRINT : PRINT : HTAB 7: PRINT "END OF MATDEMO-- BACK TO BASIC": END
6000  REM  HEADING
6010  PRINT : HTAB 5: PRINT "TYPE ";Y;" ITEM";: IF Y = 1 THEN 6030
6020  PRINT "S";
6030  PRINT " IN EACH ROW."
6040  FOR I = 1 TO X
6050  HTAB 6: PRINT "ENTER ROW ";I;": ";
6055  GOSUB 6060
6057  NEXT I
6059  RETURN
6060 L = 1
6070  FOR H = 1 TO 10
6080 S$ = ""
6090  FOR J = H TO 10
6100  GET T$: PRINT T$;
6110  IF T$ = " " THEN 6160
6120  IF T$ = "," THEN 6160
6130  IF T$ =  CHR$ (13) THEN 6190
6140 S$ = S$ + T$
6150  NEXT J
6160 C(I,H) =  VAL (S$)
6170 L = J
6180  NEXT H
6190 C(I,H) =  VAL (S$)
6200  RETURN
7000  REM  PRINT THE ANSWER
7010  FOR I = 1 TO X: HTAB 10: FOR J = 1 TO Y: PRINT C(I,J);"  ";: NEXT : PRINT
     : NEXT
7030  PRINT : PRINT "HIT 'C' TO CONTINUE:-- ";
7035  GET K$: PRINT K$; CHR$ (8);
7040  IF K$ = "C" THEN 7060
7050  PRINT "   PROGRAM STOPPED!": GOTO 20000
7060  RETURN
8000  REM  INPUT THE FIRST MATRIX
8010  PRINT : HTAB 2: PRINT "FIRST MATRIX:"
8020  GOSUB 6000
8030  FOR I = 1 TO M: FOR J = 1 TO K:A(I,J) = C(I,J): NEXT : NEXT : RETURN
8500  REM  INPUT THE SECOND MATRIX
8510  PRINT : HTAB 2: PRINT "SECOND MATRIX:"
8520  GOSUB 6000
8530  FOR I = 1 TO D: FOR J = 1 TO E:B(I,J) = C(I,J): NEXT : NEXT : RETURN
10000  IF C(1,1) = 0 THEN 3
10003  PRINT "********   DIMENSION ERROR   ********": PRINT  CHR$ (7)
10005  FOR Z = 1 TO 500: NEXT
10010  HOME : HTAB 10: PRINT T$(Z9): RETURN
20000  VTAB 1: END

LIST
10 REM4444444444444444444444444444444444444444444444444444444444444444444444
20 REM
30 REM44444444444444  P r o g r a m    4 Y E S E R E S  44444444444444
40 REM
50 REM444444444444  Written by  -  Alfred A. Adler, Ph. D. 44444444444
60 REM
70 REM444444444444  Version  1.0  -  September  1979  444444444444444
80 REM
82  DIM F(361),A(16),B(16)
83  P2=6.2831853
85 !"444444  Program  4YESERES  -  by  Alfred  A. Adler  Ph.D.  444444"
86 !
88 !"IF YOU WANT INSTRUCTIONS, RUN 1500."
90 !
167 REM BUILT IN FUNCTIONS OF TIME
177 INPUT"Choose sinusoid, square, or triangle (1, 2, or 3): ",W1
181 INPUT"State phase shift desired, in degrees: ",P1
182 D=P1/6
184 FOR Z=0 TO 60
185 ON W1 GOTO 188,192,220
186 REM BUILT IN SINUSOID
188 DEF FNF(Z)=SIN(P2*Z/60 + P2*P1/360)
189 F(Z)=FNF(Z)
190 GOTO 285
191 REM BUILT IN SQUARE WAVE
192 DEF FNG(Z)
194 IF Z>=45+D THEN RETURN 1
195 IF Z<45+D AND   Z>=15+D THEN RETURN 0
197 IF Z<15+D THEN RETURN 1
199 FNEND
200 F(Z)=FNG(Z)
205 GOTO 285
218 REM BUILT IN TRIANGULAR WAVE
220 DEF FNI(Z)
225 IF Z<=15+D THEN RETURN (Z-D)/15
228 IF Z>15+D AND Z<45+D THEN RETURN 1-(Z-D-15)/15
230 IF Z>=45+D THEN RETURN -1+(Z-D-45)/15
235 FNEND
240 F(Z)=FNI(Z)
285 NEXT
290 INPUT"What is the desired period? ",T9
300 INPUT"What time increment will be used? ",T1
305 INPUT"How many terms in Fourier series? ",N1
310 K=0
311 GOSUB 502
312   !" N",TAB(16),"A(N)",TAB(46),"B(N)"
315 REM COMPUTATION OF FOURIER COEFFICIENTS
320 FOR N=0 TO N1
330 A=0\B=0\A(N)=0\B(N)=0
340 FOR T=0  TO T9 STEP T1
342 IF T<=60 THEN 350
343 V=T+.01
344 T0=(V/60 - INT(V/60))*60
345 F(T)=F(T0)
350 A=F(T)*COS(P2*N*T/T9)
360 IF T=0  THEN A=A/2
370 IF T=T9 THEN A=A/2
380 A(N)=A(N)+A
390 B=F(T)*SIN(P2*N*T/T9)
400 IF T=0  THEN B=B/2
410 IF T=T9 THEN B=B/2
420 B(N)=B(N)+B
430 NEXT
440 A(N)=A(N)*2*T1/T9
450 B(N)=B(N)*2*T1/T9
460 IN,TAB(10),%12F8, A(N),TAB(40),B(N)
470 NEXT
475 K=1
478 GOSUB 502
480 GOTO 85
502 !
505 IF K=1 THEN 520
510 !"*********  INPUT DATA - TO BE SYNTHESIZED  *********"
515 !"------ This curve is defined to be ONE PERIOD ------"
516 !
518 GOTO 540
520 !"######  OUTPUT DATA - SYNTHESIS OF INPUT DATA  ######"
525 !
530 REM PLOT ROUTINE - PLOT AXES
540 P=3.1415927
545 A0=4102\REM 1006H
550 A1=4112\REM 1010H
555 X8=4440\REM1158H
560 X9=4441\REM1159H
565 Y8=4438\REM1156H
570 Y9=4439\REM 1157H
575 C0=CALL(A0)
580 REM C0 not required to run but it does clear X and Y.
585 C$="-"
590 FILL 4442,ASC(C$)
592 R=40
593 IF K=1 THEN R=70
595 FILL Y8,R
600 FILL Y9,0
605 REM This moves Y down to +40, where we want the X axis.
610 FOR X=0 TO 360 STEP 5
615 REM This plots X axis at 12 to the inch.
620 GOSUB 695
625 C1=CALL(A1)
630 NEXT
635 C$="1"
640 FILL 4442,ASC(C$)
645 FILL X8,0
650 FILL X9,0
655 REM This puts X at 0, where we want Y axis.
657 U=80
658 IF K=1 THEN U=140
660 FOR Y=0 TO U  . STEP 4
665 REM This plots Y axis at 12 to the inch.
670 GOSUB 730
675 C1=CALL(A1)
680 NEXT
685 GOTO 758
688 REM PLOT DATA
690 REM Subroutine to plot X (Horizontal)
695 X0=X/256
700 X2=INT(X0)
705 X1=INT((X0-X2)*256)
710 FILL X8,X1
715 FILL X9,X2
720 RETURN
725 REM Subroutine to plot Y (Vertical)
730 Y0=Y/256
735 Y2=INT(Y0)
740 Y1=INT((Y0-Y2)*256)
745 FILL Y8,Y1
750 FILL Y9,Y2
755 RETURN
758 IF K=1 THEN 850
760 REM COMPUTE AND SCALE INPUT DATA FOR PLOTTING
765 C$="0"
770 FILL 4442,ASC(C$)
775 FOR T=0 TO T9 STEP T1
776 IF T<=60 THEN 780
777 V=T+.01
778 T0=(V/60 - INT(V/60))*60
779 F(T)=F(T0)
780 X=360*T/T9
785 GOSUB 695
787 S1=40
788 IF K=1 THEN S1=70
790 Y=S1-36*F(T)
795 GOSUB 730
800 C1=CALL(A1)
805 NEXT
807 FILL 4442,95
810 S=96
812 IF K=1 THEN S = 160+(16-N1)*8
813 S0=S/256
814 S2=INT(S0)
816 S1=INT((S0-S2)*256)
818 FILL X8,0
820 FILL X9,0
825 FILL Y8,S1
828 FILL Y9,S2
830 C1=CALL(A1)
835 RETURN\REM This is necessary! (see 311 and 478.)
850 REM COMPUTE AND SCALE OUTPUT DATA FOR PLOTTING
1165 C$="-"
1170 FILL 4442,ASC(C$)
1175 FOR T=0 TO T9
1180 X=360*T/T9
1185 GOSUB 695
1186 Y=A(0)/2
1187 FOR N=1 TO N1
1188 W=A(N)*COS(P2*N*T/T9)+B(N)*SIN(P2*N*T/T9)
1190 Y=Y+W
1192 NEXT
1193 Y=70-36*Y
1195 GOSUB 730
1200 C1=CALL(A1)
1205 NEXT
1210 GOTO 765
1500 !"This is an experimental program to test various methods"
1510 !"      of synthesizing a quasi-periodic function."
1520 !
1530 ! "This program contains sinusoids, square waves, and triangles,"
1540!"all with a period of T=60. The sinusoids may be phase shifted"
1550 !"by any amount; the square waves and the triangles may only"
1558!
1560 !"be phase shifted by 0 to +90 degrees. If the chosen period"
1570 !"is a multiple of 60, the original wave will be reproduced"
1580 !"accurately, otherwise the education begins."
1582!
1583!"The time increment must be a whole number since F(Z) is a"
1584!"subscripted variable. If it is desired to use decimal numbers"
1585!"then the F(Z)'s must be converted to FUNCTIONS and lines 350"
1586!"and 390 must be altered accordingly. Futhermore, T1 must be"
1587!"evenly divisible into the fundamental period (60) or else"
1588!"the input data will be asymmetric from positive to negative"
1589!"and the analysis will be incorrect."
1590 !
1600 !"The program will cycle from page to page nicely if RUN is on"
1610 !"the second line of the page, and N1 does not exceed 16."
1620!"If values of N1 beyond 16 are desired, the dimension statement"
1630!"(line 82) must be altered."
```

THE MIND REVOLUTION

By Merl Miller

The computer pretensions to intellect have been both a theme and a concern of this column. Even though we can't ever define artificial intelligence the concern just won't go away. It seems to take on whatever meaning any group puts on it. The representation-theory researchers see intelligence as a process of problem solving; the heuristic programming groups see it as a designed response to random variables, and robotics groups research investigative instruments and machines that control themselves.

Probably the most interesting research involves the efforts to communicate directly with the machine in natural human language. The language natural to machine, in fact the only language machines understand is binary logic or arithmetic. Instructions and executions work on the simple on-or-off, digital mode of the computer's circuits and switches. There are no words or numbers as we know them in machine language, just combinations of 0's and 1's.

For several years, Noam Chomsky at MIT has tried to develop a machine-oriented approach to grammar. The intention has been to have the computer generate sentences in English that are both grammatical and acceptable. For all of his effect on linguistics, no one has been able to get his theories to work on machines. But how important is that?

To examine this question even closer, let's turn our attention to animals. For years there have been a variety of experiments involving teaching sign language to chimpanzees. The chimps can learn to express certain wants and needs using sign language and one mother even taught the language to her baby. Critics of these experiments claim that the chimps aren't using language. They claim that sign language is a conditioned behavior.

The question is, "Is conditioned behavior intelligence?" Before you answer "of course not," think about all of the things a chimp can do. If everything a chimp does is conditioned behavior, then a chimp is obviously not intelligent. If some of what a chimp does is conditioned behavior and some of what it does is intelligent behavior, then the chimp must be intelligent. (You know where I am going, don't you?) If a machine is able to emulate the chimp's behavior, then it must also be intelligent. Right?

Perhaps the basic difference between the chimp's behavior (or man's for that matter) and a machine's behavior is that the chimp is sometimes illogical, while the machine never is. Specialists have suggested that a machine can be said to think when there is no difference between what the machine says and what a human speaks in a similar conversation.

The question is: "Is conditioned behavior intelligence?"

Shortfalls in artificial-intelligence experiments might prove nothing more than the imperfectability of logic and language. The rules have always been changing.

One classic example of conditioned behavior in a computer is computer chess. Although widely touted as a form of artificial intelligence, computer chess relies primarily on search and sort techniques. The parameters are simple. First the computer checks to see if the moves made are legitimate and if there is a legitimate move that can be made. Once this is done the computer must have some means of distinguishing between good and bad positions.

A human chess player is able to determine this by feel, by experience or intelligence, but how does the computer know? The key to evaluation is knowing what to look for. A computer makes its decision by using an evaluation function. In chess, two or more features are linked together in some fashion. For instance, having two pieces attacking your king can have a variety of meanings. If the pieces are a bishop or a pawn, big deal! If they are the queen and a rook, mate! The value of the pieces and their mobility are both evaluated. If the queen can move, she has a lot more value than if she is boxed in behind a couple of pawns.

Once the values have been assigned for all the pieces and their mobility, the computer then evaluates each possible move and assigns a value to it. When all of the values are assigned, it picks the one with the highest value. Before I get a stack of letters from irate computer chess players, I should point out that this is a highly simplified version of how a computer chess program works. There has been a lot of heuristic programming done that eliminates a lot of these steps.

I believe that this is excellent programming but it is not an example of intelligent machine behavior. The greatest chess players of all times where all somewhat illogical at times. (Consider Fisher versus Spasky as an example.) A computer chess program is not capable of being illogical, consequently it is probably not capable of intelligent "thought." What do you think?□

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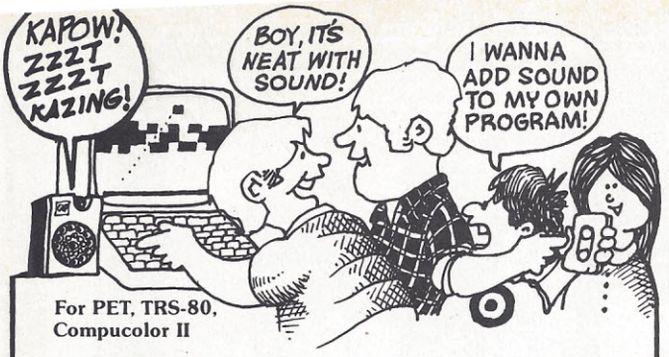

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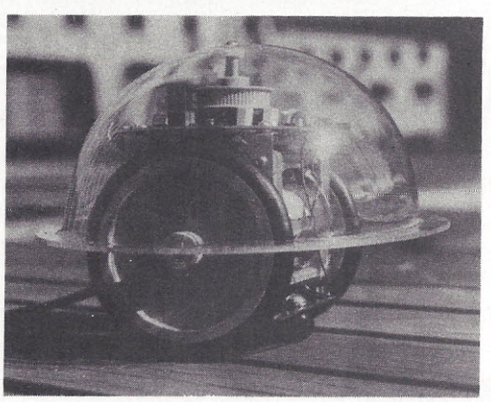

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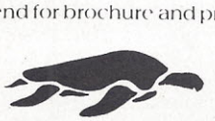

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BUSINESS SOFTWARE REVIEW

By Carl Heintz

This month, Business Software Review again focuses on operating systems. The mail I received concerning my review of CP/M (November, 1979) was astonishing. While generally I try to gear my articles towards the end user, apparently my comments on CP/M struck a responsive chord in the ears of both users and programmers. The most interesting response came from a programmer who has dealt with IBM assembly language programming for seven years. His comments were, in a nutshell, that CP/M left him in a daze.

Most comments were not derogatory with respect to the structure of the system. To the contrary, most of the mail praised the system, but condemned the awful documentation. In fact, CP/M is a pretty good system, but it does need a lot more documentation for the end user (and a few programmers besides).

This month's article focuses on an entirely different approach towards operating system design. Whereas CP/M was designed for the primitive microcomputers and has been upgraded through the years, the subject of this article, OASIS, was designed with big machines in mind and "downgraded" to run on today's evolving machines. The difference in design philosophy inherent in this statement is tremendous, and has important implications for the microcomputer user.

THE SYSTEM

OASIS is produced by the folks at Phase One Systems in Oakland, California. The system name stands for "Online Application System Interactive Software," a jazzy sounding name which fails to really describe what OASIS is all about. When I first approached the task of familiarizing myself with OASIS, I failed to appreciate the one-paragraph description included with the literature. I present it here, paraphrased to introduce the review which follows: OASIS operating system software is designed for microcomputer users and programmers who wish to generate or implement programs using [some] Z-80 based systems. OASIS implements Z-80 capabilities in creating easy-to-use tools that yield *commercial grade solutions* [my emphasis] in a wide range of applications areas. . .OASIS integrates the operations of the disks, CRTs and peripherals into a "state of the art" problem solving instrument. Thorough documentation assists the user.

That in a nutshell introduces OASIS. If you have utilized timesharing systems or have been involved in big-systems operating systems, or even some of the operating systems used in large minis such as the Hewlett Packard 3000, you will feel comfortable with OASIS.

OASIS is expensive, about $500, compared to the price for CP/M at $150 or so. But the price differential is deceiving, since OASIS includes many standard programs which are optional with CP/M. A comparison of what you would have to purchase with CP/M to make it compatible with OASIS is as follows: CP/M, $150; text editor (CP/M ED is very hard to use), $100; text output processor, $150; spooler, $100; communications package, $100; BASIC language, $150; security system, $150; total, $900.

But to truly appreciate OASIS, you have to see it. It comes in a 3-inch binder full of documentation which is written in English, understandable to those with only minimal microcomputer experience. That in itself is a breakthrough. To attempt to describe the whole OASIS system here is beyond the scope of this article, so we will focus on a few of its more interesting features.

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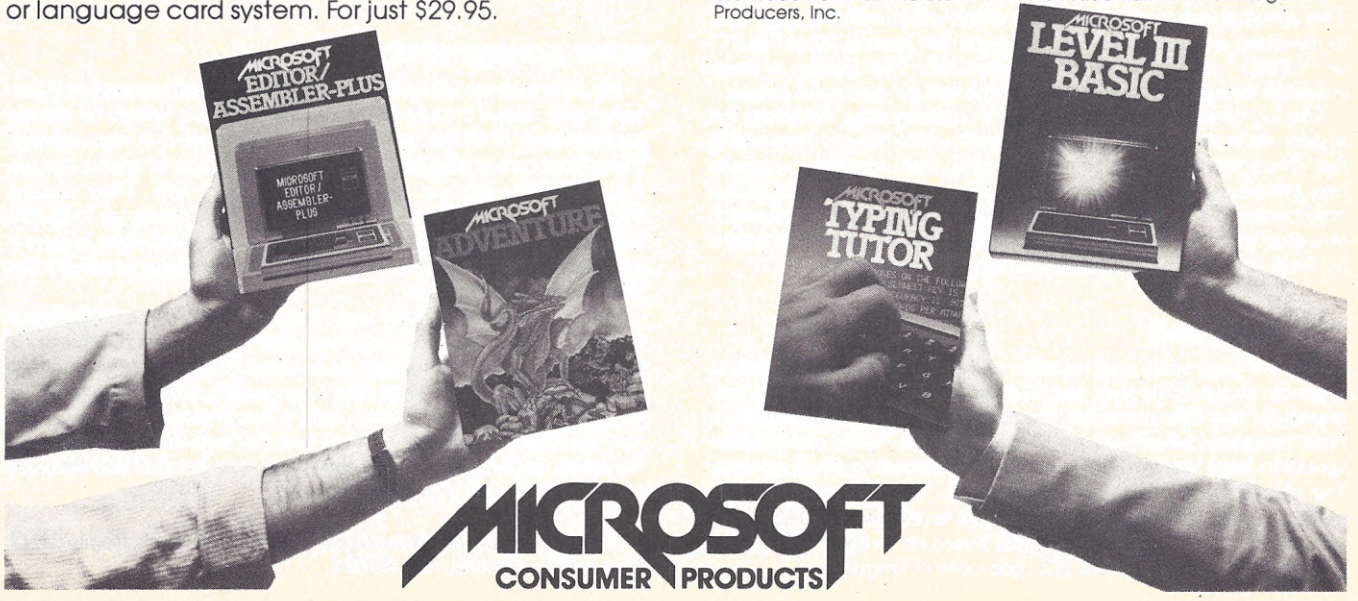

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IMPLEMENTING THE SYSTEM

The OASIS systems comes from its distributor somewhat configured for the system which it is intended to be run on. Various combinations of terminals, CPUs and printers can be utilized — the user really has to check with Phase One to be certain that the right system is ordered. For example, the memory capacity of the machine is important. A 48K configured system will not run on a 64K machine.

The "ATTACH" command is used to configure the system from a user standpoint. I was amazed to find that the driver programs supplied with the system are amazingly versatile. I was able to hook up a TTY printer and a Diablo protocol printer to the same port.

There occasionally are a few bugs which you find with any system, and most often in the case of hooking up peripherals, these occur with timing of various signals to the printer or the use of certain control codes. The ATTACH command has a useful feature which helps the user implement it — the HELP command. (Most of the OASIS commands have this HELP function). When a user is uncertain how a command works or what protocols must be used in implementing the command, by typing the command with the word HELP after it, the operating system will display on the screen a little guide to the use of the command. This is extremely useful and minimizes useless hunting in the manual.

SIGNING ON

When first booting up OASIS, you will receive a nice little "welcome to OASIS" message, followed by a query for the date and/or time. OASIS has an accounting feature which logs each time a user accesses the system (a file is kept of this to provide a history of access — just like big machines!). The time feature can only be implemented on a system which has what is known as a "real time clock," something most small micros don't have. In the future, however, it is likely that they will, and of course, OASIS is ready to accept this upgrading with little modification to the software.

. . .a password can be implemented so that only certain personnel can access certain programs.

The date function is useful, especially when the history file is examined. For the first time in commercially available micro applications packages, some usable record of machine usage can be generated.

But this is only the beginning — OASIS has a "log-on" feature. This allows a user to specify a code which will launch the system into the direct execution of a user program. No need to input "RUN" or "LOAD" or any such other command. This feature is made available through an "executive" which will be discussed below.

The log-on has another aspect to it — user security. All files in the system are coded with a user access level, which ranges from one to five. The system disk can be configured so that users have access to only certain programs. Also, a password can be implemented so that only certain personnel can access certain programs. This feature is one outstanding security aspect to the system which sets it in a class by itself, and is very reminiscent of large-scale systems.

THE EXECUTIVE

Users of large scale systems often utilize "executive" programs to organize and execute their applications processing. Executive programs act like little controller programs which govern the applications programs which will be loaded and run. Their use is widespread in large systems, while relatively unknown in small systems. The closest thing most systems have is a "link" command which guides the processing from one program to another. In OASIS, the executive programs are just like those I used on an IBM 360 several years ago. It is in essence a JCL (job control language).

DOWN TO BASICS

The best of the OASIS system is not found in the operating system. The true beauty of the OASIS package is in the super BASIC which comes with it. Choose from an interpreter or a compiler, both are available. The compiler can be made to act like an interpreter, which is unusual and outstanding.

The single greatest aspect of the BASIC on OASIS is the choice of file types — three types are supported: sequential, direct and indexed sequential. Any programmer will appreciate the ease of programming with indexed sequential file structures, and the immense power such file structure can give to applications programs.

There are some unusual commands available under OASIS BASIC, too: The USR function which lets the program go directly to an assembly language program and execute it, returning to the BASIC program afterwards; the LINPUT statement which allows a complete line to be input as a single character string; the LINPUT USING command which allows a formatted input string of the entire line; the MOUNT statement which allows a user to change disks mid-program; the WAIT statement which allows a user to instruct the machine to wait until some event at a port or device has occurred.

The documentation is similarly outstanding. The BASIC section of the OASIS documentation is over 134 pages long. Examples are concise and definitive. Even a programming novice can appreciate the power of this interpretation of BASIC.

EDITING TEXT

The OASIS system comes equipped with a sophisticated but complex text editor. The editor is specifically designed to edit programs, but it functions nicely for text such as this article also. Editing functions are divided into the entry of data, edit or the whole thing (so-called "global" searches) and editing of characters (such as in the case of a word processing editor).

The trade-off between power and complexity is probably most evident in the edit program. While it is immensely powerful, it's a little complex for the novice to put it up and get running. The manual probably could have had an example or two more to clarify the use a bit better. However, I found it relatively easy to get going once I stumbled around with it for a while. Experience is the best teacher in the case of a text editor.

SCRIPT PROCESSOR PAR EXCELLANCE

As if they hadn't gone far enough, the OASIS package includes an outstanding word processing output processor. This set of programs takes a text-edited file and produces beautiful, formatted output. It's best suited for the production of manuals and books, since it has numerous features such as indexing and chapter commands. It will construct your table of contents, maintain page headings and footings, justify and fill, paginate and number pages, even include the date if you wish. It will even use a sophisticated SECTION command to set up various "levels" or subsection indentations in a table of contents or index.

SOME CONCLUSIONS

My own feelings about the system are best summarized by a personal note: I have chosen OASIS as the operating system for the implementation of all the production programs used in my business. They have certain disadvantages: they utilize a lot of space; the system disk they are on will be half or more full. They require, therefore, at least a two disk system (OASIS supports up to 8). On the other hand, OASIS is fully compatible with hard disks in its present state, so no "kluges" or "fixes" will be necessary to adapt it to a Winchester environment.

Further, to an old CP/M user, certain of the programs appear at times to be running slowly, but one must consider the complexity of the programs and the numerous overlays which go on during program implementation. They aren't appreciably slower than many interpretive BASICs, and overall, with a reasonably fast floppy, function more than satisfactorily. I am told that with the programs on a hard disk, such as the Corvus, the speed is so fast that their throughput compares with minicomputers.□

Carl Heintz can be contacted at Business Software Review, P.O. Box 1234, Cerritos, CA 90701.

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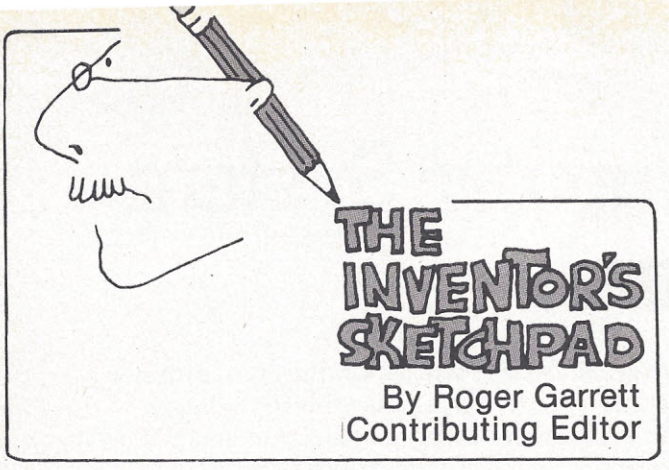

THE INVENTOR'S SKETCHPAD

By Roger Garrett
Contributing Editor

Take a moment and consider: how would you communicate with others if you could not speak — if you were mute? You could learn signing, the "speaking of the hands." But then, you could only communicate with those who know how to read sign language. You would still be cut off from the majority of people who do not know how to interpret your hand signals.

Perhaps you could carry a pad and pencil and write down everything you wanted to say. Yet that is a very awkward way to carry on a conversation and you still could not "talk" with little children; you could not call to your pet; you could not yell "I'll be there in a minute" to the fellow at the front door.

So what would you do? Turn to microprocessors, of course. And that is just what at least one manufacturer has done. A device about the size of a clipboard, with a large array of buttons, is now available. Each button corresponds to either a common phrase such as "hello" or "where is the bathroom?", or one of the sixty-four phonemes. A phoneme is a sound, such as the "th" sound or the "oo" sound, which when combined with other phonemes produces articulated speech.

The operator of the device simply presses the appropriate sequence of buttons to produce the words and sentences he wishes. The built-in computer interprets the button presses and, via a speech synthesizer, actually pronounces the words and phrases. All of this is just great, because it really does exist and does solve the problem of how the mute can communicate.

Yet a device the size of a clipboard (approximately 9" by 12" by 1") is more than a bit awkward to carry. So. . .

FIGURE ONE

Let's design a smaller model. First of all we will have to change the basic input concept. In the previously described device there was a separate button for each phoneme and common phrase. This is essentially what dictates the rather large dimension of the unit. Instead of utilizing "discrete keys" we will employ the "chord" concept. When you play a chord on a piano you are playing one unique "sound" but you utilize several fingers to activate that sound. In our device we have five buttons, one for each finger on your hand. In order to select a unique phoneme the user simply presses the appropriate combination of buttons.

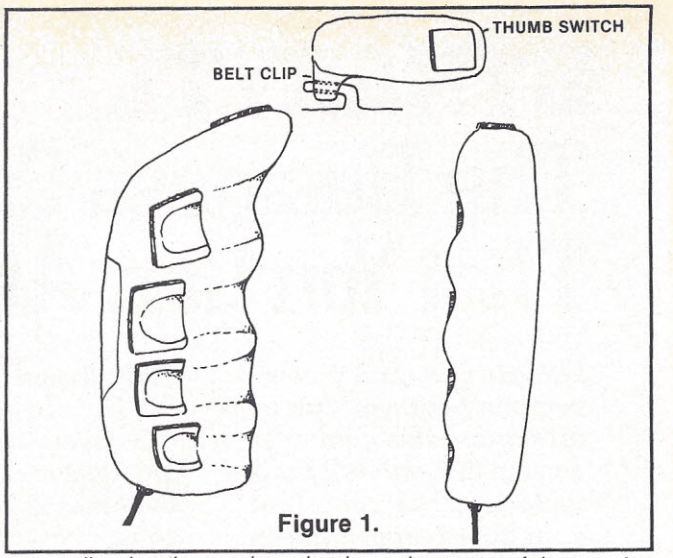

Figure 1.

Since there are only thirty-one unique combinations with five fingers (we assume that "no fingers pressed" does not constitute a phoneme selection) we will require that two separate presses will be required to select any of the sixty-four phonemes. In fact, the first press could always be a simple either-or press: either the thumb is pressed or the index finger is pressed. This tells the microprocessor that the subsequent "chord" will signify one of the lower thirty-two phonemes or one of the upper thirty-two (assuming that the sixty-four phonemes have been divided into two sets).

Since we only have five buttons we no longer need such a large device. We can design it to fit the hand, as shown here.

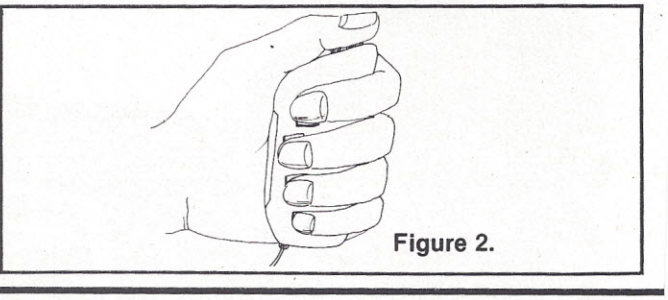
Figure 2.

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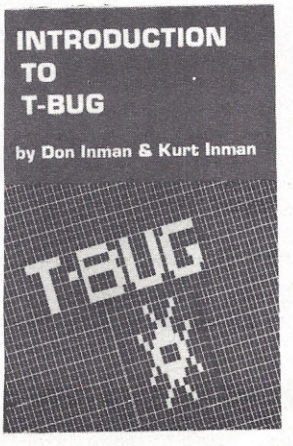

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FIGURE TWO

The device fits nicely into the palm of your hand so that it is not so obvious as carrying a clipboard.

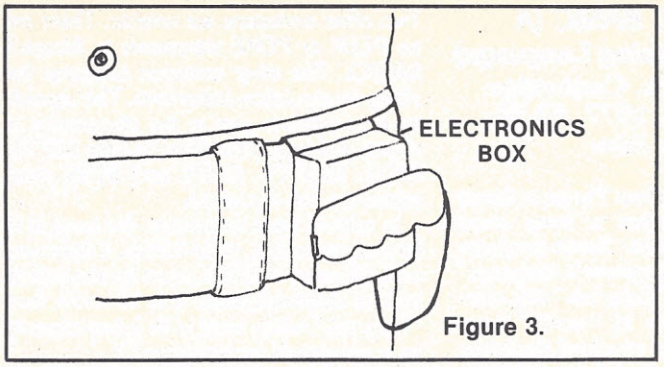

Figure 3.

FIGURE THREE

Since we may be hard pressed to fit an entire speech synthesizer into the button unit, we will mount most of the components into a small box to be clipped onto the user's belt. The hand unit is connected to the belt unit by a short cable and clips onto it. By positioning it at waist height it is always within easy reach. Since it clips to the belt it can be put out of the way when not in use but is always available.

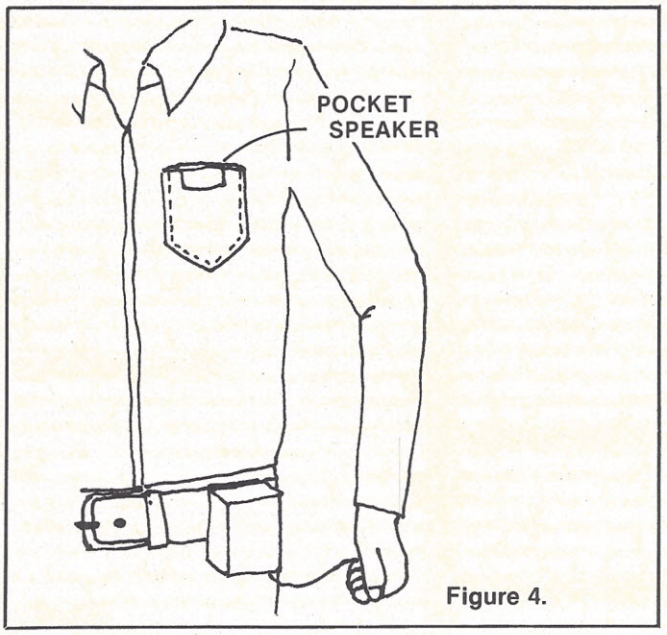

Figure 4.

FIGURE FOUR

Since it would be a little unnatural to have a voice coming from your waist, we mount the speaker in a vest pocket.

The question arises of how fast a person can press buttons to produce the appropriate stream of phonemes. Won't it be difficult to teach the mute how to operate the device? After all, sixty-four unique phonemes is quite a large set and there is often little correspondence between the phoneme string for a given word and its corresponding spelling.

It is true that the potential user will have to learn to "spell" in phonemes but that is comparable to learning a foreign language. If they can learn "signing" then learning the phoneme "language" should be no problem.

As for pressing the buttons fast enough, a study was done by the army back in the late 1950s of the ability of typists to type using a chord keyboard. This keyboard consisted of two five-button pads and each letter and symbol of the standard typewriter keyboard was represented by a unique two-handed chord. The study found that the typists could actually type faster and more accurately using the chord system than they had using conventional typewriters.

So speed and accuracy should be of no concern with our five-button unit. All we need now is for some community-minded company to produce the unit and make it available to the speech-disabled so they may more fully communicate with the speaking world.

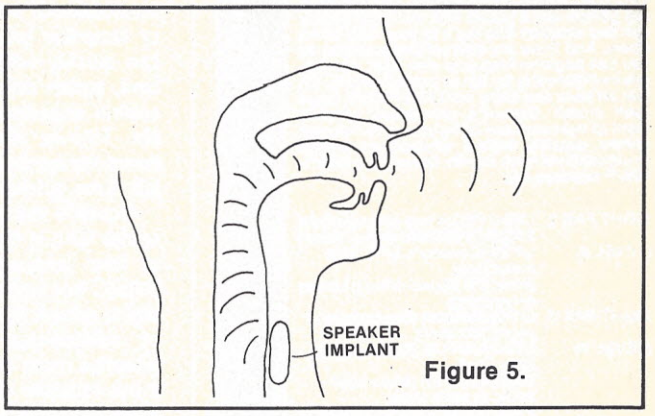

Figure 5.

FIGURE FIVE

And finally, a rather far-fetched extrapolation of our device. Might it be possible to implant the speaker portion into the voice box of the user so that the sound actually emanates from his mouth? The speaker could be "linked" by radio frequency to the hand-held unit. The speech would be perfectly natural sounding and natural appearing. A listener might never know that the speaker was actually mute.□

Roger Garrett can be contacted at Inventor's Sketchpad, P.O. Box 1234, Cerritos, CA 90701.

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BOOK REVIEWS

ILLUSTRATING BASIC (A Simple Programming Language)

By Donald Alcock. Cambridge University Press, 1977. $3.95

Reviewed by Bradford Rehm

With so much talk about Pascal in the air these days, one reviews a book about BASIC with reservations. Some programmers speak of the "beginner's language" with disdain, calling it "baby talk" with computers. They object to its "wordy" command syntax, its lack of structural discipline, and its limited data manipulation capabilities.

Nevertheless, many hackers know the language, making it a defacto "medium of exchange" for games and application programs. BASIC is hard to beat when it comes to simply banging out a program.

Provided the user doesn't have to become involved with intricate string manipulations or recursive program elements, he or she can quickly write routines to crunch numbers, gather data, plot graphs, monitor and control experiments, or talk with peripherals. This is, after all, what many microcomputer applications call for — getting the job done quickly and effectively.

Alcock's text will be more useful for the reader who is learning BASIC as a second or third language or who already knows BASIC but wants a handy, quick-reference text to refresh the memory about the formats of seldom-used statements. Though it assumes more esoteric needs and interests, it has requisite clarity and simplicity. It also offers the advantage of being serviceable for users of many different versions of the language.

With the manuals for various BASICs at hand, Alcock can point out where the versions differ, and more importantly, he can suggest ways of writing programs so that they will be executable on all or most of the systems.

Covering several versions of the language in this manner could lead to some tedious discourses about the various editions, but in fact the "Some BASICs" statements don't have to be invoked often enough to become bothersome. The longest continuous list of them appears in the discussion of basic line formats.

Each function is given one or two pages of description. This allows treating most of them on opposing pages, so that when one turns to DEF, for example, its text appears on the adjacent pages 26 and 27, and there is no need to turn pages to skip from one part of the discussion to another. There are seven relating to the use of DEF in those two pages.

The PRINT statement is one of the few in the book which require more than two pages of description (unless one counts the various discussions of matrix operations and chains). Here there are elementary examples of the PRINT statement, followed by a discussion of zones, the tab-fields into which each line is divided. Missing are discussions of different forms of the print statement which are probably peculiar to current microcomputers.

Two other omissions are notable. There are no PEEK or POKE statements in Alcock's BASICs. The other omission concerns the string manipulation statements. The capability is covered in part in the discussions of chains and textual variables, but the LEFT$, MID$, RIGHT$, CHR$ and STR$ statements are not discussed.

In spite of these omissions, the book is to be recommended. What it does, it does very well. All users of BASIC must be aware of its lack of standardization. It is far more than "baby talk" when used to its fullest capacity by a competent programmer.□

MICROPROCESSORS

By Rodnay Zaks. Sybex, Inc. 1979 413 pages, $9.95

Reviewed by Jeremy Epstein

Microprocessors is a tutorial on microcomputers from a hardware standpoint. Although the author states that no background is necessary, some experience with computers from either a hardware or a software standpoint would be useful.

The book is organized in a hierarchical manner, presenting CPU chips and their operation first, then buses, and building up to complete systems. The book contains detailed descriptions of microcomputer architecture and operation from chips to buses, and surveys interfaces, applications of micros, and system development. There is also a short overview of software from a hardware standpoint.

As can be assumed from the title, the book concentrates on microprocessors. It contains good overviews of the manufacturing process, and the different technologies available.

Buses, instruction formats, and almost every other aspect of microprocessors one would want to know about are also covered. A number of case studies of specific chips help the reader to understand the application of the techniques discussed.

Microprocessors also contains several appendices which list such useful information as instruction sets for some of the more common micros such as 6800 and 808, bus signal lists for the S-100, a fairly complete list of manufacturers, and a very worthwhile list of acronyms. The thorough review of all of the popular microprocessors giving both advantages and disadvantages of each chip is very interesting for readers not familiar with the market.

In contrast to many other hardware oriented books, this book tends to be easy t read. The conversational style liberal sprinkled with charts, photographs and d grams leads to a pleasantly educating perience. For beginners in the field, a co to-cover reading would be well worthwhile, while for advanced users it might prove useful as a reference text.

The one problem with the book, and many others, is that in such a rapidly changing field the information rapidly becomes obsolete. Provided one looks more at techniques than specific examples, this should not be too significant.□

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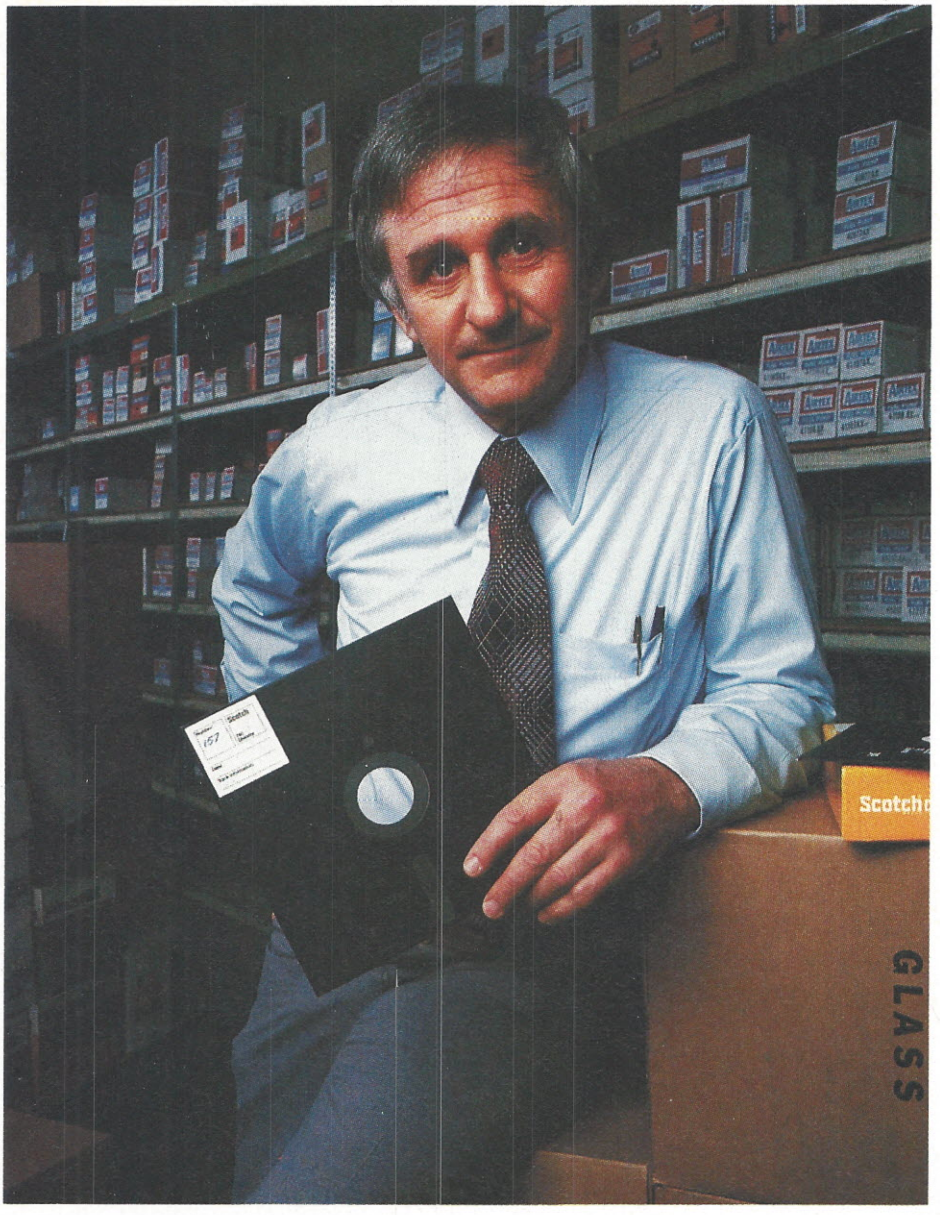

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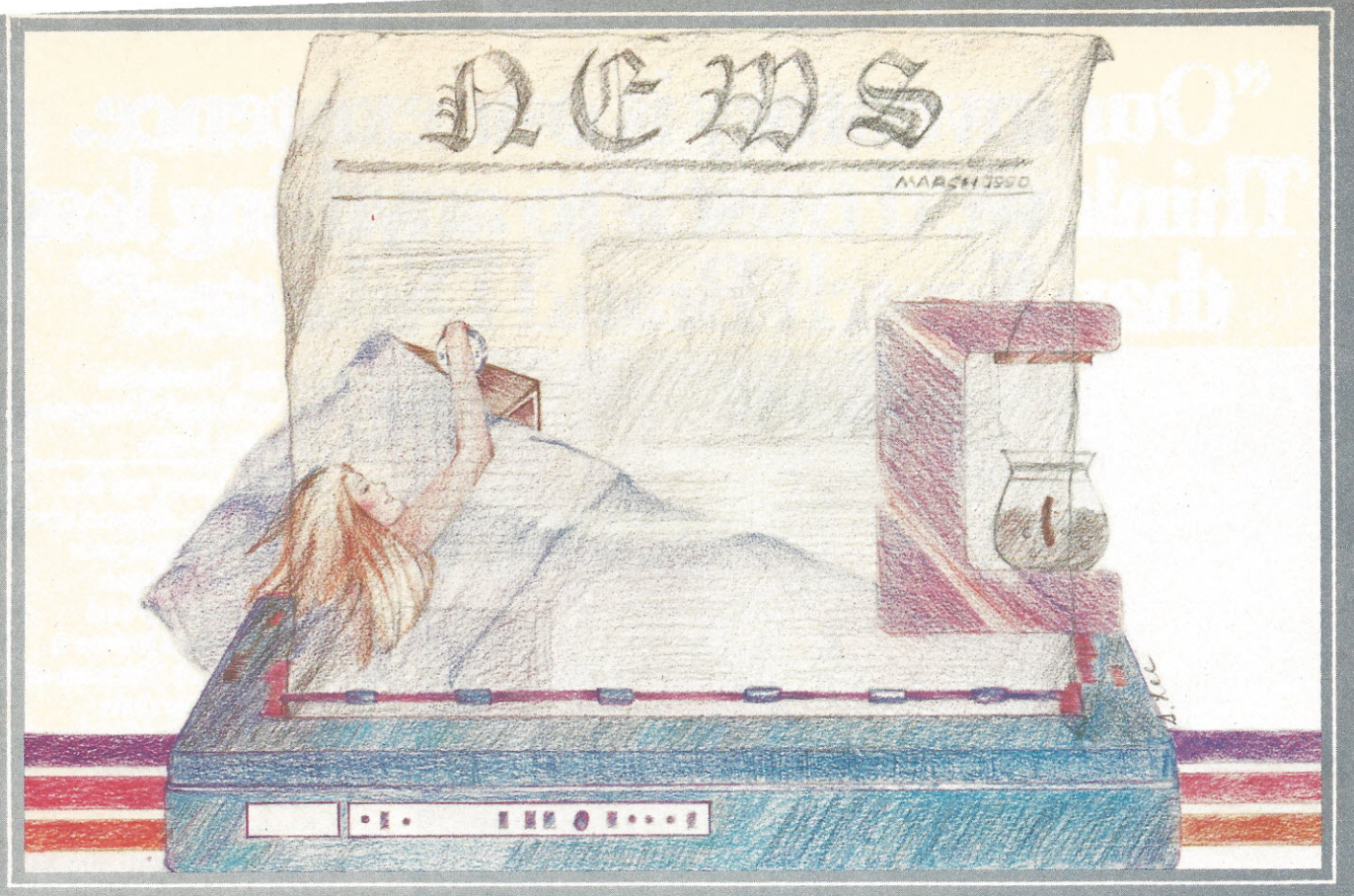

Computerized Communications Systems for the 1980s

By Jonathan Sachs

It's 7:15 on a Saturday morning in 1990. Jane Doe reaches out and turns off her alarm clock. In the ensuing quiet, she can just hear the buzz of her data printer as it prepares her morning newspaper in the kitchen.

Today Jane wants the newspaper before anything else. Stopping only to turn on her coffee pot, she takes it from the printer and sits down to read.

The newspaper would not have been recognized by a reader of 1980. Not only is it computer-printed, with somewhat crude dot-pattern illustrations; it is only six typed pages long. There are a half dozen articles in it, and a list of headlines, and a few want ads.

Jane scans the headlines. Many of them concern wild animals living in cities, which is one of Jane's interests. She has programmed her computer to collect every article that is "published" on that topic. Today one of the headlines interests her, so she enters a command on her control console to print its full text.

Next, she studies the want ads. That's what she got up to see, for Jane is an avid music lover, and she is hoping to find tickets to a concert that has been sold out for weeks.

Bingo! There's a person offering two tickets. There is no phone number in the ad; none is necessary. Jane displays the ad on her console's screen and types in an offer. If the seller happens to be at his computer, he'll see it now. If he's still asleep, he'll see it later.

Jane is in luck. The seller answers immediately. In a typed "conversation" they make a deal, exchange names, and agree to complete the sale at the seller's home at 1 p.m.

Now Jane must find out how to get there. She calls up a "menu" of things her computer can do, and touches a line that says "information." The menu is replaced by another one that lists kinds of information that are available. Jane touches "transportaton," getting another menu. She ends up with a bus schedule and a route map, which she prints out to take with her.

It's 7:30 now. Jane's coffee is ready.

Public information utilities like the one Jane used are becoming a major frontier for computer development in the 1980's. They may affect the lives of large numbers of people in much less than ten years. A few systems are already in use.

Two utilities now available in Great Britain illustrate the forms such systems are taking.

Ceefax, a system run by the British Broadcasting Corporation (BBC), uses a television signal as its transmission medium. The signal can carry regular programming at the same time, since the digital information is only transmitted in the interval when the receiver's picture-forming electron beam is returning from the bottom of the screen to the top.

Ceefax transmits information in "pages" of text, each containing 24 lines of 40 characters. It takes 0.25 second to transmit a page. Ceefax customarily transmits 100 pages in an endless loop, repeating every 25 seconds. A television set with a suitable adapter can select a page by number, decode it, and display it on the screen for as long as the viewer wishes.

Ceefax is used to transmit information of general interest, such as weather, news bulletins, sports results, food prices, and recipes. Its capacity is limited by its cycling time: the more pages transmitted, the longer it takes to transmit them all, and the longer it may take the viewer to obtain a certain page after he requests it.

Prestel, run by the British Post Office (BPO), represents another kind of public information utility. It also uses television to display information, but transmits the information via telephone.

Prestel stores data on a computer at a regional center. To use it, a customer calls up the computer on his telephone. Through a phone connection to the television set, the computer displays a list of available pages of data (a "menu") on the TV screen. The user can select a page by pressing buttons on a control module. The computer responds by displaying a more detailed menu, from which the user can select another page. This process quickly leads him to pages that contain the information he wants.

Backers of Prestel and Ceefax consider the two systems to be complementary. Prestel is designed to offer up to a half million pages of information, much of it specialized in nature, but must transmit to each user individually, and so can serve only a limited number of people at one time. Ceefax provides only about a hundred pages of general interest information, but can simultaneously serve every user within range of the transmitter.

Prestel is supported in part by customer charges for viewing pages of information; Ceefax is free (except for Britain's regular annual license fee for a TV set). The signal processing needed to receive Prestel on a TV set is so similar to that needed for Ceefax that one adapter may easily be designed to do both.

Prestel and Ceefax are both publicly available. Ceefax became a standard part of the BBC's broadcasting service in 1976, and is available in virtually all parts of Britain. Prestel graduated from market trials into limited public service in March 1979. Initially, Prestel was offered only in London; it was to be extended to other large cities, and within a few years to all of Britain.

The public has been slow to accept these new services, a fact which most observers attribute to the high cost of current receiving equipment ($600 to $900) and a lack of public awareness that they exist.

Prestel and Ceefax represent two classes of public information utilities that are developing. Prestel-type systems, characterized by interactive communication between a computer an individual users, are known generically as "videotex" systems. Ceefax-type systems, characterized by one-way transmission over unused parts of a television carrier, are known as "teletext" systems.

Other nations are developing their own information utilities. The French have Antiope, a teletext system with improvements over Ceefax in the technique used for encoding information. The Canadian Department of Communication has Telidon, which can be configured for either teletext or videotex operation, and excels in high-resolution graphics.

In the United States, several broadcasters are experimenting with teletext systems. They include KSL-TV of Salt Lake City and KMOX-TV, a CBS affiliate, in St. Louis. No receivers are for sale, since these tests are strictly technical in nature.

The Electronic Industry Association (EIA) is drafting a proposal for teletext transmissions compatible with American television, which it expects to form the basis for FCC rulemaking on teletext transmission standards. Such standards would make public teletext services possible in the U.S.

Videotex is being tried out on this side of the Atlantic as well. General Telephone and Electronics Corporation has been licensed to market Britain's Prestel system in the United States and Canada. Meanwhile, Knight-Ridder Newspapers, Incorporated, headquartered in Miami, is pilot testing a videotex system it calls Viewtron in 1980. The initial test will involve 150 to 200 families in the Miami area; if the tests are encouraging they will lead to larger tests and then to a generally available service.

DIGICAST

While the American communications industry is moving slowly toward teletext and videotex services, a small company near San Francisco is developing a novel approach to digital information utilities which may be the precursor of workable systems.

The company is the Wireless Digital Corporation, of Woodside, California. Jim Warren Jr., its founder and president, is developing a system around the personal computer rather than the television set.

Wireless Digital's system, Digicast, transmits digital information on the carrier wave of an FM radio station. The station's regular audio programming is not disturbed.

To receive Digicast transmissions, one must have an FM receiver designed to detect Digicast data rather than audio signals. The receiver's output is a train of on/off electrical pulses representing bits of data, in the same format that computers use to communicate with each other.

A personal computer connected to the Digicast receiver will be able to display the received information, save it, scan it for keywords or phrases, or extract data from it as a starting point for computations. The computer's behavior will be determined by the program it runs, and so will be under control of the user.

The computer, Warren stresses, is the key feature distinguishing Digicast from other kinds of public information utilities. Because the computer is programmable, Digicast can do things none of the other systems do.

The impact of the computer is illustrated by Digicast's information capacity. Although Digicast signals are transmitted in much the same way as teletext signals, the amount of information a Digicast channel can carry is huge by comparison.

To see a teletext page, a user must select the page and then wait for his television set to pick up the page from the transmission. To save time, the system retransmits everything continuously, limiting the amount of material that can be presented to about 96,000 characters.

Since Digicast transmits to a computer, it does not need to retransmit continuously. It simply trusts the receiving computer to save any material that will interest its owner. This means that the great bulk of material need be transmitted only once. Even time-critical information like stock quotations need be transmitted only as often as a reasonable user might want to see it updated.

If a Digicast channel runs at its planned speed of 960 characters per second, sends everything twice to overcome transmission errors, and runs only from midnight to 6 a.m. to free the computer for other daytime uses, it will be able to transmit over 10 million characters per day — over 100 times the capacity of a teletext channel. This is equivalent to almost 1,400 tabloid newspaper pages.

Digicast's large information capacity enables it to carry large volumes of information that only a few people may want, such as weather in foreign cities, newsletters of small organizations, and esoteric classified ads. In this sense, it is more like videodex than like teletext. But videotex requires an expensive, complex computer system to begin service. Digicast, like teletext, requires only a little extra equipment added to an existing transmitter, and a small computer to feed the transmitter data.

The originators of Digicast feel it should be self-supporting from the start, with no help from the government. But this poses a problem: No one will market receivers until Digicast is being transmitted, and no one will transmit it until the receivers are being used.

Warren feels the company can overcome this problem, which is quite similar to television's early dilemma, by offering data for persons very interested in a specific field.

For example, retailers might get an up-to-date list of stolen credit cards. Or real estate agents might use Digicast to learn about new listings before published reports announce them.

Because Digicast is geared towards computer hobbyists at this time, the first system is being started in the San Francisco-Silicon Valley area where home computers are common. Free services will be transmitted first, with expanded low cost services coming later.

General interest information will be free to all users. Advertising and material such as airline schedules will be supported by the information provider. News, stock quotations, and similar material will be financed by sponsors or absorbed into Wireless Digital's overhead.

Some kinds of special purpose services will be supported by user subscriptions. Examples are special-interest newsletters, multiple listing services for real estate agents, and databases for lawyers, doctors, and other professionals. Each month, the user will pay a fee and obtain a decrypting key which his receiver must have to make sense out of the service when it is broadcast. Other kinds of service will be offered on a charge-for-use basis.

The user's computer will do much more than record information coming from the Digicast receiver and play it back on demand. By processing the received information in various ways, it will provide services that the Digicast receiver by itself could not provide.

Stock quotations, for example, will be transmitted in a standardized format, making it easy for a computer program to extract data on particular stocks. For a person concerned with the performance of the stock market, the computer could run a sophisticated analysis and monitoring program with input from this source.

News stories will be headed by lists of key words, the electronic equivalent of headlines. By scanning the incoming key words for items of interest, a computer can record only those stories its user might want to see. Later it can print the entire list, letting the user decide which stories to read without looking at them all. A computer with limited storage capacity can record key words only, allowing the user to select stories to be recorded from a second transmission the following night.

Want ads can simply be transmitted in the order they are received. Each user's computer will filter out the ads that interest its owner. There will be text processing routines to aid this process. If a user wants to buy a 64K Memetronic computer with disk drives for under $4,000, for example, he will be able to ask the computer to save every ad that contains the words "Memetronic" and "disk," a number 64 or greater followed by the letter "K" or "k," and a dollar amount no greater than $4,000.

The volume and economy of Digicasting will make it reasonable to use want ads for some brand-new purposes. One possibility is the community bulletin board, a forum for bringing together people with common interests or needs *other* than buying and selling.

Digicast's start-up costs will be lower than those of a teletext or videotex utility, probably in the range of $30,000 to $50,000 for a modest installation. And subcarrier channels may be leased for a few thousand dollars per month or less, depending on the leasing station's carrying power and the local demand for channels.

These low costs will make it relatively easy for small businesses and non-profit organizations to afford Digicast broadcasting time, or even to do their own broadcasting. Digicast promises to become an alternative communications medium for groups that can't afford television, radio, or newspaper publishing. Local control and locally oriented content will be easier to achieve than they have been in most conventional media.

Field tests were conducted in the fall of 1979 near San Francisco and Sacramento, California. They demonstrated that Digicast is a viable medium under "real world" conditions, and can transmit reliably to almost any location where FM audio reception is acceptable.

Since then, Wireless Digital has been arranging the manufacture of Digicast receivers, and has begun negotiating with FM stations and information providers to begin service in the first half of 1980. The earliest stations will be located in the San Francisco Bay area, probably near San Jose.

Wireless Digital hopes to begin service in 10 to 20 other areas over the next few years. It will concentrate on high technology centers where many people are receptive to communicating through a computer.

HOW THE SYSTEM WORKS

Digicast "piggybacks" information on an FM station's carrier wave by a technique called subcarrier modulation. It is the same means used to combine the two channels of a stereo transmission.

A basic FM signal consists of a carrier wave that changes its frequency when modulated by an audio signal. At any instant, the polarity and amplitude of the modulating signal determine the direction and amount of the carrier wave's deviation from its "home" frequency.

Thus, a graph of the carrier wave's frequency over time looks just like the modulating waveform. This is how FM — frequency modulation — gets its name.

In stereo broadcasting, the carrier wave is modulated simultaneously by *two* signals. One is an audio signal consisting of the sum of the left and right stereo channels. This is called the "L+R channel." The other is a 38 kHz "subcarrier" which is amplitude-modulated with the *difference* between the left and right stereo channels. This is called the "L-R channel."

A stereo receiver can separate the resulting waveform into its components with little distortion, and recover the left and right stereo channels by adding and subtracting the signals on the L+R and L-R channels. A monaural receiver simply presents the L+R channel and ignores the L-R channel.

The FCC's rules also allow an FM station to have a second subcarrier at 67 kHz. This subcarrier has traditionally been used by subscriber-supported background music services, like that offered by the Muzak Corporation. But the subcarrier may be used by any kind of broadcast programming, regardless of its form — and that includes Digicasting. This is the primary reason why Digicast uses FM radio as a medium, rather than television: TV-based teletext services may wait years for FCC approval, but Digicast is possible today.

Digicast uses frequency shift modulation of the 67 kHz subcarrier to transmit digital data. A shift of 4 kHz down (to 63 kHz) represents a binary 1; a shift of 4 kHz up (to 71 kHz) represents a binary 0.

Data is encoded in 8-bit ASCII, transmitted asynchronously at up to 9600 bits per second (effectively 960 characters per second). Initial services may use a lower data rate to avoid outrunning some of the slower personal computers now in use.

To further reduce the processing load on the computer, a Digicast data stream is divided into several "subchannels" carrying different kinds of information: news, stock quotations, advertisements, and so forth. Packets of data from different subchannels are interspersed, with an identifying header preceding each packet. The computer can direct the receiver to send it only the packets that belong to a particular subchannel. Since the computer sees only a fraction of the packets the receiver gets, it has ample time to process each packet before receiving the next one.

All aspects of the basic Digicast transmission protocol have been fully disclosed by the Wireless Digital Corporation, and are in the public domain. This will make it possible for qualified communications engineers to design Digicast equipment conforming to Wireless Digital's standards.□

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CIRCLE INQUIRY NO. 44

Communicating With Your Computer

By Edgar M. Pass

The usefulness of a computer may be greatly increased through the use of communications hardware to enable the computer to transmit and receive data from a remote location. This would enable the exchange of programs over phone lines, storage and retrieval of programs at a time-sharing service, use of the computer from a remote location, or use as an intelligent (or dumb) terminal.

This article discusses how to configure a system to use each of these modes of communication effectively. It is concerned primarily with the SWTPC 6800, though many of the considerations also apply to other systems, especially those with ROM or PROM monitors.

The SWTPC 6800 lacks a front panel like that found on the Altair systems. It contains a monitor (known as MIKBUG) which normally operates over a control interface and has only two standard switches, POWER and RESET. The monitor may make it much simpler to use the computer from a remote location. Since the POWER switch will normally be left on, the RESET switch remains as the only mechanical problem in operating remotely.

INTERFACING THE UNITS

The obvious solution to the problem of attaching a modem, or data set, to the 6800 is to use a serial interface board. This method is effective and has the following advantages:

- The serial interface (ACIA) may be used in an interrupt-driven mode, as opposed to the control interface, which may not;
- The clock rate of the serial interface may be set independently of that of the control interface, ranging from 75 to 9600 bits per second;
- Complicated line disciplines may be implemented more easily using the serial interface than the control interface, which is based on a bit-banging parallel interface (PIA).

However, the use of the control interface has the following advantages:

- MIKBUG automatically controls the control interface, whereas a program is required to control a serial interface;
- MIKBUG provides the console commands G, L, M, P and R (for controlling the computer) only through the console interface;
- The serial interface costs thirty-five dollars (a minor disadvantage).

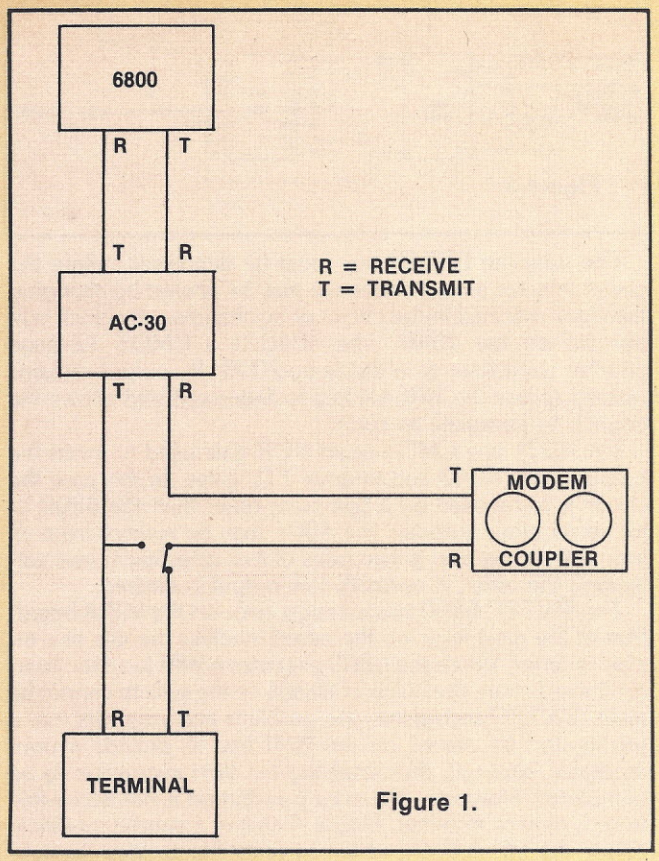

Figure 1.

REMOTE CONTROL OF THE COMPUTER

The basic configuration of the system is shown in Figure 1. The following cases of this configuration are useful:

- To communicate with remote device but not 6800:
  place AC-30 in local,
  place modem in half-duplex unless remote device echoes input,
  throw switch toward terminal;
- To receive from remote device into 6800:
  place AC-30 in remote,
  place modem in half-duplex,
  throw switch toward terminal;
- To communicate with remote device using 6800:
  place AC-30 in remote,
  place modem in full-duplex,
  throw switch away from terminal.

Note that the remote device may be another computer or a terminal.

The modem in all cases must be in the proper ORIG or ANS mode in order to communicate at all. This requires advance knowledge or coordination; however, the modem is usually placed in ORIG mode when it is used to place a call. If the remote device is a time-sharing system, one must be familiar with its procedures for receiving, saving and transmitting files.

Many systems will not accept a long stream of continuous data, requiring that the 6800 simulate a teletype in terms of XON-XOFF protocol. This means that the time-sharing system will transmit an XON to the 6800, to which a program in the 6800 will respond with one line of data followed by an XOFF, to which the system will respond by sending an XON, and so on.

Another familiar problem is that the 6800 may be required to transmit its data in even (or odd) parity. MIKBUG zeroes the high-order bit when it receives data, and ignores deleted characters. It does transmit all eight bits of data, however. To compute the parity of a given character, a routine must count the number of 1-bits. If this number is even (odd) parity, the high-order bit is reset (set) for even (odd) parity. In order to enter the necessary time-sharing-system commands, either include this logic in the 6800 program or temporarily set up the system to communicate only with the remote device.

If the remote device is another computer or terminal, the entire process may proceed as if the user were at the console of the other computer. Thus files could be transferred from cassette, memory, or disk to the other device. The MIKBUG commands may be adequate for this process, assuming that you can coordinate the operation with the other user while he is attempting to perform this process.

ANSWERING THE PHONE

In the other case, you are at a terminal remote from your computer and wish to access it when it is unattended. The first problem, getting the computer to answer the phone, has several solutions. One is to purchase a modem or modem board containing the logic to answer the ring and to disconnect the line when the session is complete. Such a modem or modem board is usually fairly expensive (unless it can be obtained from surplus) and may require a program running in the computer for proper operations.

Another solution is to build a circuit similar to that shown in Figure 2. This circuit provides an output of +5 volts whenever it detects a ringing impulse on the phone line or Data Carrier Detected level on the line from the modem. The output can then be used to answer the phone by triggering a reed relay or other mechanism. The output will remain high for about ten seconds after being triggered by either input, thus allowing for initial carrier detection, momentary carrier loss or false rings without requiring any special software support. It will remain high as long as the phone is ringing or carrier is detected.

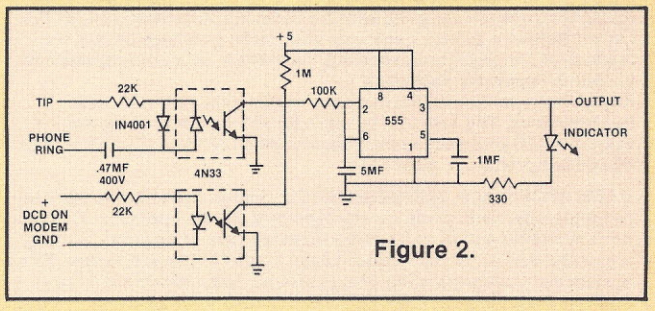

Figure 2.

Dependent upon the voltage levels of the ringing signal on the phone line and the data carrier detected signal from the modem, the corresponding resistors may require adjustment to insure proper operation. The 555 is used as a Schmitt trigger. It is fired by either of the opto-isolators beginning to conduct enough to discharge the 5MF capacitor. It is reset when the 5MF capacitor recharges. The times of charging and discharging the 5MF capacitor may be changed by substituting other values for the 1 Megohm and 100 ohm resistors or the 5MF capacitor itself. Telephone company regulations may require the use of a DAA (data access arrangement), rather than the direct connection of this circuit, an auto-answer modem or modem board, or any other foreign equipment to the telephone line.

IMPLEMENTING THE RESET

Once the phone is answered, the next problem is to implement a remote reset operation for the 6800. The modification shown in Figure 3 will allow the simulation of the depression of the RESET button on the console of the 6800 by holding the BREAK key on the terminal down for more than one second. This circuit may be constructed on a handy one-IC breadboard and attached to the back of the control interface board. The 16 x 150 baud clock may be found at the socket of that board. The wire to MRST may be taken through the top connector through the index pin by replacing the MOLEX plug in that position.

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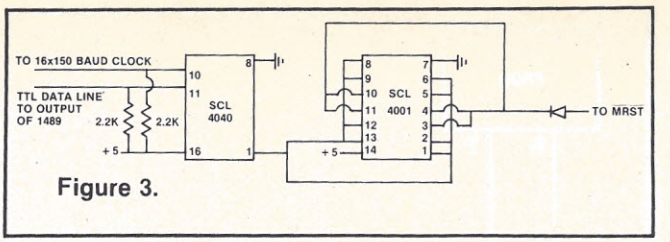

Figure 3.

The time the BREAK key must be depressed before the circuit initiates a reset sequence may be altered by changing the clock attached to the circuit or by changing the clock output pin on the 4040. The 4040 is a CMOS 12-stage counter used here as a divide-by-2048. Its output remains cleared unless the BREAK key is depressed and allows the counter to complete its cycle.

The 4001 is a CMOS quad NOR gate used to invert the output of the 4040 and to drive TTL gates. In this case the circuit is to be used on a computer other than the 6800 or for some other purpose, the 4001 may be rewired from all four gates in parallel to two pairs of two gates each, one pair feeding the other, if normally-low output is desired.

The SWTPC 6800 has a design error on the MP-A board. Part of the reset logic on the board involves the use of a tri-state inverter. When the 6800 executes a WAI (wait for interrupt) instruction, the bus is tri-stated, so the system cannot be reset. SWTPC recognizes the problem and suggests that a pushbutton be placed on the NMI line to provide a non-maskable interrupt, thus enabling the WAI instruction to be completed. However, this extra pushbutton is not accessible from a remote terminal. Figure 4 shows a simple modification to the MP-A board which corrects this problem by substituting a spare normal inverter gate for the tri-state inverter at pins 2 and 3 of IC15.

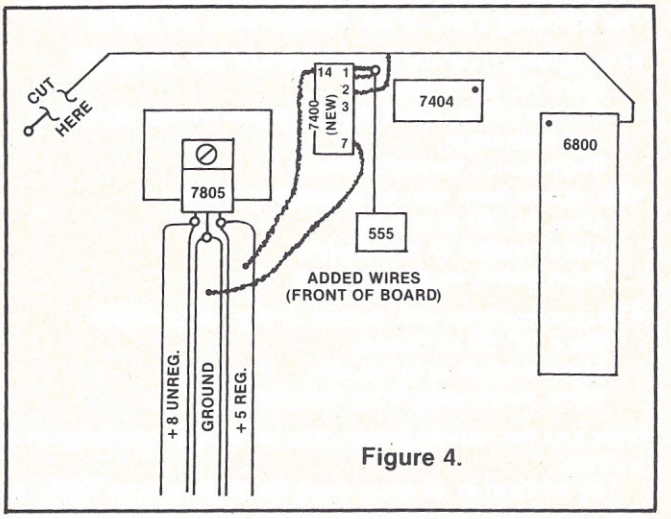

Figure 4.

In order to best use the computer remotely, plan ahead. If a floppy disk drive isn't available, either leave a program in memory (such as BASIC or an assembler) or have a means of loading long programs at the remote location. This method could include another AC-30 borrowed from the computer system, or a cassette recorder on which the desired programs have been recorded using modem tones. If a floppy disk drive is used, it may be necessary to make up and mount a floppy disk with the programs to be used. In any case, leave the computer turned on and the system configured for remote access.

With the system wired as shown in Figure 1, and with the modifications shown in Figures 2 through 4, any computer should be more useful than before. Communication lines will become usable for the transfer of data and files to and from remote devices. You will even be able to call your computer from a remote terminal or computer and use it almost as if it were physically close.□

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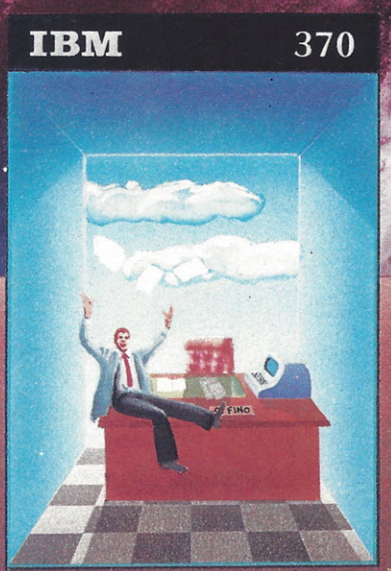
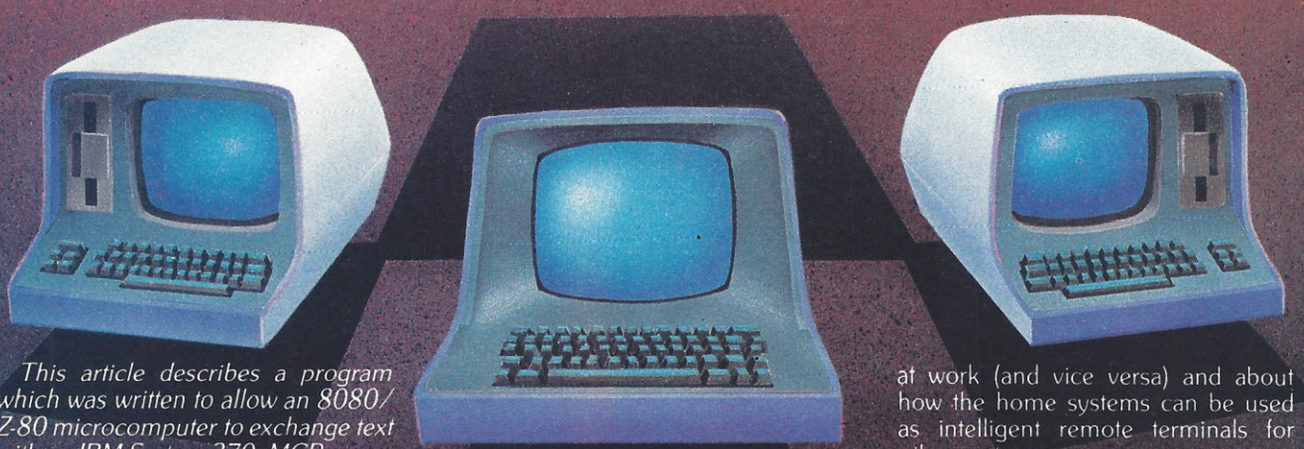
MCP: A MICRO COMMUNICATIONS PACKAGE

By Dr. Bradford Rehm





This article describes a program which was written to allow an 8080/Z-80 microcomputer to exchange text with an IBM System 370. MCP recognizes a simple ASCII line protocol and is capable of sending blocks of text to the 370 line-by-line, continuously or automatically, using cues derived from the line protocol. Buffering of text or object-format programs received from a host system is also provided, so that material can be off-loaded, edited, and later returned to host files.

The program is easily adapted for operation with other large systems. It also allows an 8080-based system to operate as an intelligent remote terminal and to exchange object programs with other computers, including other micros.

Many who own and use microcomputers at home also use large mini or maxi computers at the office or at school. Almost inevitably, questions arise about how text or programs written at home can be transferred to the system at work (and vice versa) and about how the home systems can be used as intelligent remote terminals for other systems.

Wouldn't it be handy, for example, to be able to review a company report in the comfort of the living room, instead of having to stay at work after hours or carry a ten-pound printout home and cover the dining room table with it?

WHAT SHOULD IT DO?

MCP meets these general requirements

1. The system must allow its local console to serve as a console for remote systems, obeying the appropriate character-oriented line protocols.
2. The system must be capable of sending a memory-resident buffer which begins at location 100H and is bounded by pad characters (OFFH's). The pad characters must not be transmitted with the data.

Illustrated by Fino Ortiz

3. The system must be capable of simultaneously displaying and storing data received from the communication port. Storage must be in a memory-resident buffer, beginning at 100H. Pad characters (0FFH's) must be automatically inserted at the beginning and end of the buffer.
4. The following characteristics must be alterable by means of console commands:

   End-of-Line character: a CR (0DH) or DC-3 (13H)

   Full- or Half-Duplex Operation

   Transparent or Normal Mode (store all characters or store only printing ASCII characters)

   Send mode: Transmit text or other data continuously, a line at a time, or using cues derived from the host's line protocol.

THE "TERMINAL EMULATOR" SOFTWARE

The software which allows the micro system to emulate a terminal checks the status of the modem receive port and prints any data found there on the system console device. If a status check is negative, it looks at the keyboard status and forwards any available data to the modem. The modem receive status is checked, in fact, in many of the MCP subroutines. This is done in order to reduce the chance that a character will arrive from the remote system and be ignored.

The routines which accomplish this and also transmit a DC-3 instead of a carriage return appear in the listing shown under the Mode 2 Command Loop and beginning with the routine called "XMT".

LINE PROTOCOLS

The remote System 370s with which MCP was to communicate offer two services which are of interest. Information Management System (IMS™) gives access to reports and other data stored under a variety of file names. Time Sharing Option (TSO™) permits editing text or programs and submitting a variety of jobs to the system.

Although either ASCII or EBCDIC terminals may be dialed into the system, I choose to emulate only the ASCII variety, since I have no need for the larger character set. There are many kinds of ASCII terminals, though, so the 370s are set up to service a number of them with common software.

Some remote devices, for example, have 72- and others have 132-column printers. Servicing all of them without losing characters after carriage returns require sending 18 pads (7FHs) after each line feed/carriage return. Other terminals which may be permanently wired or "dialed" into the system require additional control characters to activate them and position their print heads in preparation for the arrival of a message.

If the aim of the project were simply to emulate a general purpose terminal, virtually all of this control information could be allowed to pass through to the display device. Most video display software ignores it anyway. But since it would be necessary to provide a means of storing downloaded data for editing, it was important to be able to strip most of the control characters from the data stream. If this were not done, those characters would either disrupt the operation of the local text editor or cause an abort when the text is sent back to the host.

The next task was to provide the means of returning data buffers to the host. If the latter were a dedicated computer, as would be the case if it were another micro, this would only require a routine which moves the data, byte-by-byte, out of a memory-resident buffer into the communication port. Since the 370s are timeshared, this simple approach is not workable. They accept continuous lines of data, but occasionally appear to stop functioning after a line has been sent because they have committed resources to servicing other users.

The sending terminal knows when this occurs by means of the line protocol. All data lines sent to the host must be ended with the DC-3 (13H) character. This prevents the terminal, which is running in half-duplex mode (it prints characters as it sends them, instead of letting the host echo them for printing), from executing a line feed and carriage return. The host stores the line ended by the DC-3, and when it is ready for the next line, it transmits a line feed, carriage return, pads and, in some cases, additional control characters.

For communication with systems which are not timeshared, the capability of sending entire buffers of text, nonstop, was added. A "controlled" transmission mode, in which successive lines can be sent, one at a time, was also added because it would be useful in setting up modem levels and adjusting other equipment. When these capabilities are used, the carriage return end-of-line character will be required, because this kind of activity will often take place between two micro systems. Thus a command was included to allow switching from the default DC-3 to a CR.

THE COMMAND MODES

An operator can use the MCP console for any of three kinds of activities — to configure MCP or exit to an external monitor, to converse with the host and transmit a buffer, and to converse with the host and receive a buffer. Three Command Modes were set up to allow this, and the capabilities provided in each are shown in Table 1.

Table 1. MCP Command Functions

Mode 1 — Command Mode
- — C Set end of line function:
  D = DC-3 (13H)*
  C = CR (0DH)
- — D Set send mode option:
  A = Auto (waits ½ second after host sends last character)*
  C = Continuous (sends entire buffer nonstop)
  'CLEAR' = Send one line (CLEAR = "File Separator": 1CH)
- — F Set send mode:
  H = Half-duplex*
  F = Full-duplex
- — Q Reinitialize to default values
- — R Go to Mode 3 (Put received data in buffer)
- — S Go to Mode 2 (Send data from buffer)
- — Z Display command configuration
- — CTRL-X Exit to monitor (saving registers for examination or change)

Mode 2 — Send Mode
- — 'CLEAR' Initiate text transmission (for any option selected in Mode 1)
- — CTRL-SHIFT-N Go to Mode 1
- — CTRL-R Go to Mode 3
- — CTRL-T Send Log-on Message No. 1
- — CTRL-Y Send Log-on Message No. 2

Mode 3 — Receive Mode
- — CTRL-SHIFT-N Go to Mode 2

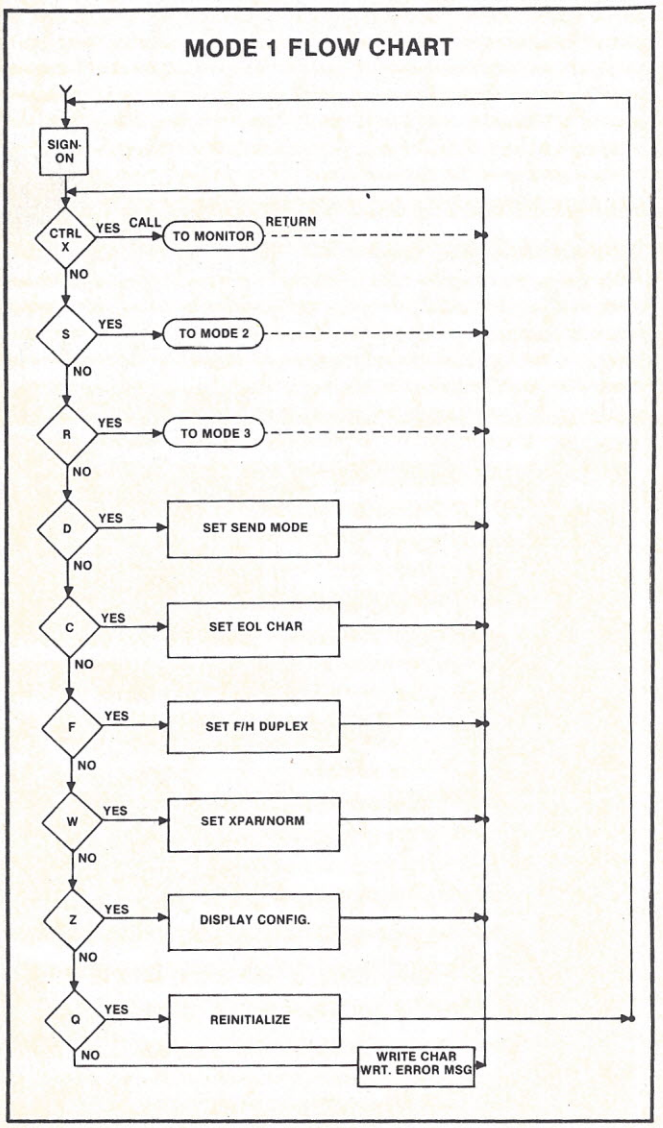
*Indicates default values.

No means was provided to display the position of the memory buffer pointer, since this function is available in most system monitors. An exit was provided, therefore, to a monitor entry point which does not destroy program register contents when it is called or when the program is reentered.

One could also ask why routines were not provided to open and close files in, say, a CP/M disk system. A primary reason was the desire to keep MCP short and simple. In its

present form, it can be installed in a single 1K x 8 EPROM or made part of an EPROM-resident operating system, so that the communications capability would be available from the moment the system is turned on.

Although they would have been a convenience, the disk I/O routines would also have been redundant, since CP/M provides the "SAVE" command for storing files and the "PIP" program for outputting files to a system "device,"



USING THE MCP COMMANDS

In Mode 1, the operator may exit to the system monitor, reinitialize MCP, check its current configuration, and reconfigure it. The monitor exit is a CALL and assumes that registers are saved, so that the buffer pointer may be examined or changed and the system returned to MCP with the changes intact.

The auto-send feature assumes the host will send a CR in the process of responding to a transmitted EOL character. When the returned CR has been "caught," MCP waits in a ½-second loop for each character until the host has stopped sending. It then returns to transmit mode and sends the next line.

Full- or half-duplex transmission is selected by entering F. The default mode is half-duplex. Selecting full-duplex causes the send mode byte to be set to 'auto-send,' which is required for full-duplex transmission.

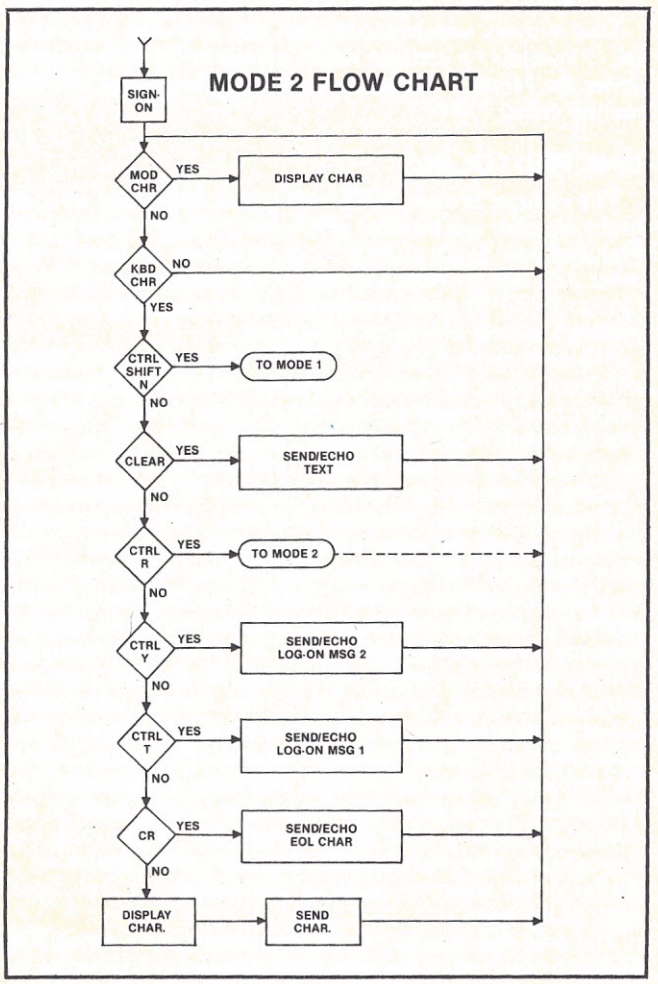
W allows the operator to determine whether text received and stored in a buffer (beginning at 0100H) will be stored in 'normal' or 'transparent' mode. In 'normal' mode, non-printing data are stripped. In 'transparent' mode, all data, including control characters and HEX values above 7EH, are stored and sent to the console. 'Transparent' mode is therefore used in receiving object programs, and 'normal' is used in receiving and storing source programs or text. In Mode 2, in which the buffer is sent to the host, all transmission is transparent, except that the OFFH pad character is stripped.

The Z command displays the command configuration of MCP, so that when default characters are altered, the operator is able to confirm that they have been set properly. Note that the 'CLEAR' character will not be displayed on some terminals.

A CTRL-X causes a return to the system monitor. The return is accomplished with a CALL to an address in the monitor, which does not cause CPU registers to be reset. Thus the H & L register pair, which contains the MCP's buffer pointer, may be examined and changed. The system may then return to MCP, which will operate using the new buffer pointer.

The Q causes MCP to reinitialize, setting operating parameters to default values and positioning the buffer pointer again at 0100H.

Going from Mode 1 to Mode 2 (Send Mode) is accomplished with a CTRL-S. A CTRL-R moves control from Mode 2 to Mode 3, and an R moves control from Mode 1 to Mode 3. Movement "backward," from Mode 3 toward Mode 1 is accomplished with the CTRL-SHIFT-N, one mode at a time.



In Mode 2, transmission of "logon" messages one and two is initiated by the CTRL-T and CTRL-Y, respectively. Text transmission is initiated by depressing the CLEAR key. It may be stopped at any time by depressing another key, which will cause its character to be transmitted and return the system to console operation.

All data returned from the remote system is stored in the text buffer, while in Mode 3. Characters entered in the local console are not stored in the buffer.

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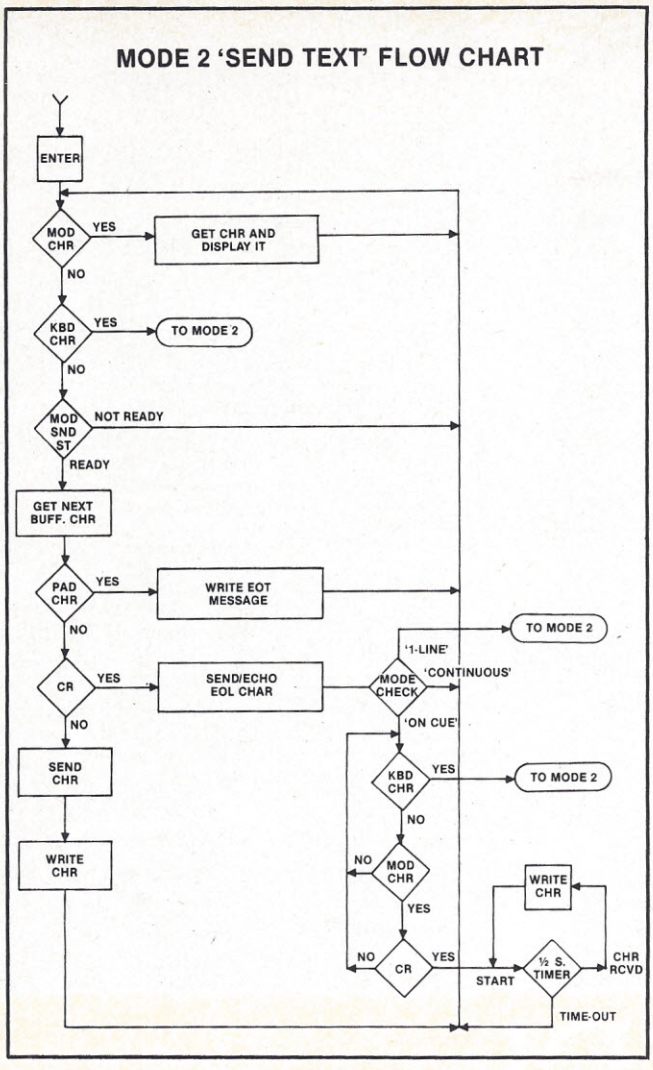
CIRCLE INQUIRY NO. 18



THE MCP CONSOLE

The three vectors at the beginning of the list of global equates handle input and output to the console device. The vectors shown call corresponding vectors in the Technical Design Labs (TDL) Zapple™ monitor, located on a TDL System Monitor Board. These vectors are based on conventions similar to those used in Processor Technology's SOLOS and in other 8080 monitors. They are also similar to a subset of the conventions suggested by Digital Research for CP/M Basic I/O System device control. The following explanations will help those who use different schemes to adapt MCP to their own systems.

CSC = Console Status Check, which finds if the console status port status bit has changed value, indicating that character has been entered. The service routine sets the zero condition bit if data is available. Source for a routine which accomplishes this for status port 2, bit 2 could be written as follows:

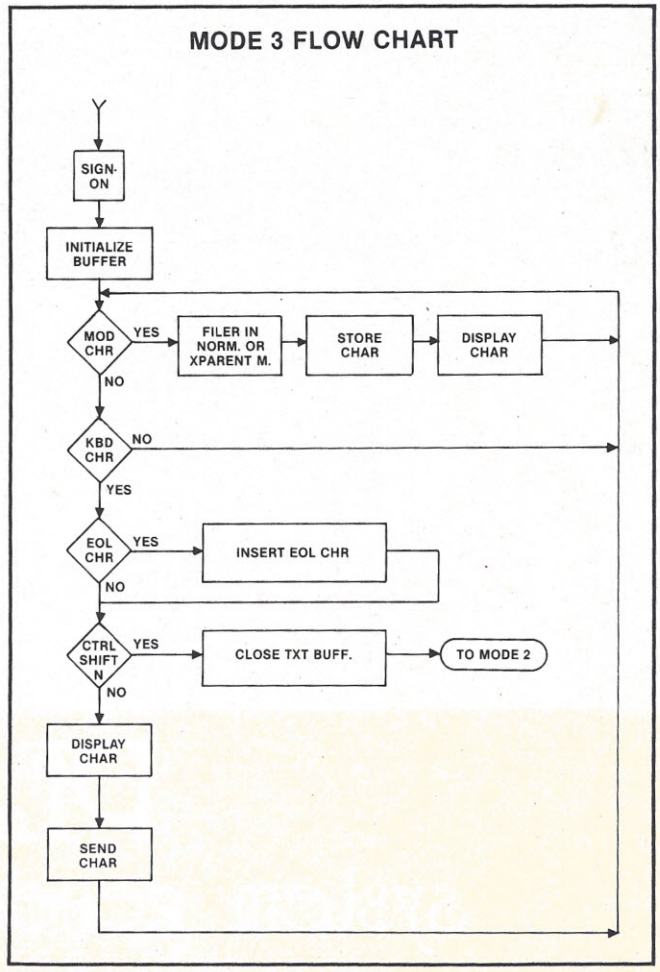
```
CSC':   IN 02H   ;READ STATUS PORT
        ANI 2    ;GET DATA AVAILABLE BIT
        RET      ;RETURN TO MCP
```

CCF = Console Character Fetch, which checks the console status port, waits for the arrival of a character, and then returns the character in Register A. The routine could be written as follows for status port 2 and data port 1:

```
CCF':   IN 02      ;READ STATUS PORT
        ANI 2      ;GET DATA AVAILABLE BIT
        JNZ CCF'   ;LOOP UNTIL THERE IS DATA
        IN 01      ;READ DATA PORT
        RET        ;RETURN WITH IT
```

COT = Console Output routine, which accepts a character to be printed in Register C and returns with it in Register A. The routine can be written as follows:

```
COT':   MOV A,C   ;PUT CHARACTER IN A
        OUT 01    ;PRINT IT
        RET       ;RETURN WITH CHAR IN A
```



ADDITIONAL SUGGESTIONS

The console data rate should be greater than the modem port baud rate if the system writes to it serially. This is necessary so that a character can be written to it in less time than it takes for the next character to be received at the modem port.

Remember to change the modem status and data port assignments so that they conform to those used in your system.

If MCP is to be placed in read-only memory, the variable storage and stack area will have to be moved to read/write memory. Twenty-two locations are required, and the entire group of variable locations can be moved by changing the VST equate appropriately.

Don't forget to enter logon messages 1 and 2 in the source program before assembly. These are found at IST and TST in the Text Storage area of the program. If your message consists of fewer than 21 characters, enter the messages first and fill out the remainder with spaces. The last character in each string should be the appropriate end-of-line character for the system you are using — a DC-3, CR, etc.

If the modem to be used with MCP has a full/half duplex switch, place it in "full" duplex, even if half duplex operation is required. MCP will provide the half-duplex character return.□

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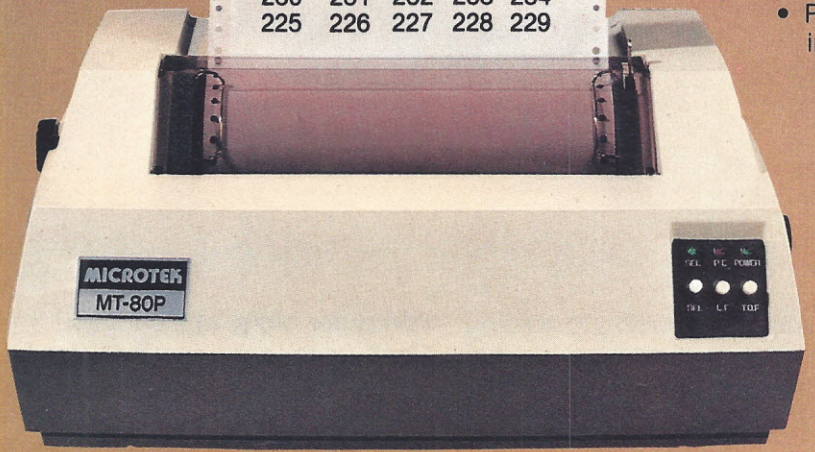

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PROGRAM LISTING

```
                        ;                *** MCP/3 ***
                        ;
                        ;MICRO COMMUNICATIONS PACKAGE
                        ;VERSION 1.0, FEBRUARY 1, 1979
                        ;
                        ;***********************************************
                        ;
                        ;            *** GLOBAL EQUATES ***
                        ;
F012                    CSC = 0F012H    ;CONS STATUS CHECK (ACTIVE LOW)
F003                    CCF = 0F003H    ;CONS CHAR FETCH
F009                    COT = 0F009H    ;CONS OUTPUT
F01E                    MON = 0F01EH    ;MONITOR RESTART ENTRY POINT
0073                    MOD = 73H       ;MODEM DATA PORT
0072                    MST = 72H       ;MODEM STATUS PORT
0001                    MSM = 01H       ;MODEM INP ST MASK (ACTV HIGH)
0002                    MSK = 02H       ;MODEM OUTP ST MASK (ACTV HIGH)
0013                    CRD = 13H       ;DEFAULT EOL BYTE (DC-3)
0041                    ATS = 41H       ;DEFAULT AUTO-SEND BYTE (AUTO)
0048                    DPB = 48H       ;DEFAULT DUPLX MODE BYTE (HALF)
004E                    DMC = 4EH       ;DEFAULT RCV MODE BYTE (NORMAL)
0100                    TPT = 0100H     ;TEXT POINTER
03ED'                   VST = TST+22    ;DEFINE VARIABLE STORAGE AREA
03ED'                   DMA = VST       ;RCV MODE BYTE ADDR
03EE'                   DPL = VST+1     ;DUPLEX MODE BYTE ADDR
03EF'                   AUT = VST+2     ;AUTO-SEND BYTE ADDR
03F0'                   DCR = VST+3     ;EOL CHAR ADDR
0402'                   STK = VST+21    ;STACK POINTER
                        ;
                        .PREL           ;ASSEMBLE IN RELOCATABLE FORMAT
                        ;
                        ;***********************************************
                        ;
                        ; *** MODE 1 INITIALIZATION & COMMAND LOOP ***
                        ;
                        ;INITIALIZE MCP & GO TO MODE 1
                        ;
0000' 31 0402'          STR:    LXI SP,STK      ;SET STACK POINTER
0003' CD 0362'                  CALL CRF        ;SEND A LF/CR
0006' 21 0379'                  LXI H,SON       ;SET MSG PTR
0009' CD 017D'                  CALL WRT        ;WRITE IT
000C' 21 0100                   LXI H,TPT       ;SET TEXT POINTER
000F' 3E13                      MVI A,CRD       ;SET DEFAULT CR
0011' 32 03F0'                  STA DCR         ;STORE IT
0014' 3E41                      MVI A,ATS       ;SET DEFAULT AUTO-SEND
0016' 32 03EF'                  STA AUT         ;STORE IT
0019' 3E48                      MVI A,DPB       ;SET DEFAULT DUPL MODE
001B' 32 03EE'                  STA DPL         ;STORE IT
001E' 3E4E                      MVI A,DMC       ;SET DEFAULT MODE CHAR
0020' 32 03ED'                  STA DMA         ;STORE IT
                        ;
                        ;MODE 1 COMMAND LOOP
                        ;
0023' CD 0362'          LOP:    CALL CRF        ;WRITE A LF/CR
0026' 0E43                      MVI C,43H       ;PUT PROMPT IN C
0028' CD F009                   CALL COT        ;WRITE IT
002B' CD 0362'                  CALL CRF        ;WRITE A LF/CR
002E' CD F003                   CALL CCF        ;GET CONSOLE CHAR
0031' E65F                      ANI 5FH         ;CONV. TO UC/NP
0033' FE18                      CPI 18H         ;IS IT A CTR-X?
0035' CC F01E                   CZ MON          ;IF YES, MONITOR RST
0038' FE53                      CPI 53H         ;IS IT AN S?
003A' CA 018C'                  JZ SNDT         ;IF YES, MODE 2
003D' FE52                      CPI 52H         ;IS IT AN R?
003F' CA 02C5'                  JZ RCVT         ;IF YES, MODE 3
0042' FE44                      CPI 44H         ;IS IT A D?
0044' CA 0069'                  JZ CAS          ;IF YES, CHG A/S
0047' FE43                      CPI 43H         ;IS IT A C?
0049' CA 0094'                  JZ ACR          ;IF YES, ADJ EOL CHAR
004C' FE46                      CPI 46H         ;IS IT AN F?
004E' CA 00C4'                  JZ DPX          ;IF YES, DPX ADJ
0051' FE57                      CPI 57H         ;IS IT A W?
0053' CA 00F5'                  JZ RMM          ;IF YES, RCV M. SET
0056' FE5A                      CPI 5AH         ;IS IT A Z?
0058' CA 011B'                  JZ DCC          ;IF YES, COMM DISPL
005B' FE51                      CPI 51H         ;IS IT A Q?
005D' CA 0000'                  JZ STR          ;IF YES, REINITIALIZE
0060' CD 0374'                  CALL SPW        ;WRITE CHAR
0063' CD 016B'                  CALL INV        ;WRITE ERROR MSG
0066' C3 0023'                  JMP LOP         ;LOOP AGAIN
                        ;
                        ;DETERMINE IF TEXT WILL BE SENT CONTINUOUSLY
                        ;(COMMAND 'C'), ON A 'CLR' (COMMAND 'CLR')
                        ;OR AUTOMATICALLY, ON A CUE FROM THE HOST
                        ;(COMMAND 'A').
                        ;
0069' E5                CAS:    PUSH H  ;SAVE THE TEXT POINTER
006A' 21 0385'                  LXI H,CSA       ;LOAD TEXT ADDR
006D' CD 017D'                  CALL WRT        ;WRITE THE STRING
0070' E1                        POP H           ;GET THE TEXT POINTER
0071' CD F003                   CALL CCF        ;GET CONSOLE CHAR
0074' E65F                      ANI 5FH         ;CONV. TO UC/NP
0076' CD 0374'                  CALL SPW        ;WRITE IT
0079' FE43                      CPI 43H         ;IS IT A C?
007B' CA 008E'                  JZ X1..         ;IF YES, LOAD A C
007E' FE1C                      CPI 1CH         ;IS IT A 'CLR'?
0080' CA 008E'                  JZ X1..         ;IF YES, LOAD A 'CLR'
0083' FE41                      CPI 41H         ;IS IT AN A?
0085' CA 008E'                  JZ X1..         ;IF YES, LOAD AN A
0088' CD 016B'                  CALL INV        ;ELSE, WRITE ERROR
008B' C3 0069'                  JMP CAS         ;MSG AND TRY AGAIN
008E' 32 03EF'          X1..:   STA AUT         ;STORE IT
0091' C3 0023'                  JMP LOP         ;GO TO MODE 1
                        ;
                        ;SELECT END-OF-LINE CHARACTER--A DC-3 OR LF/CR
                        ;
0094' E5                ACR:    PUSH H          ;SAVE THE TEXT POINTER
0095' 21 038F'                  LXI H,CRT       ;LOAD TEXT ADDR
0098' CD 017D'                  CALL WRT        ;WRITE THE STRING
```

```
009B'   E1              POP H           ;GET THE TEXT POINTER
009C'   CD F003         CALL CCF        ;GET CONSOLE CHAR
009F'   E65F            ANI 5FH         ;CONV. TO UC/NP
00A1'   CD 0374'        CALL SPW        ;WRITE IT
00A4'   FE44            CPI 44H         ;IS IT A D?
00A6'   C2 00B1'        JNZ A1..        ;ELSE, A C?
00A9'   3E13            MVI A,13H       ;PUT A DC-3 IN A
00AB'   32 03F0'        STA DCR         ;STORE IT
00AE'   C3 0023'        JMP LOP         ;GO TO MODE 1
00B1'   FE43    A1..:   CPI 43H         ;IS IT A C?
00B3'   C2 00BE'        JNZ A2..        ;ELSE, TRY AGAIN
00B6'   3E0D            MVI A,0DH       ;PUT A CR IN A
00B8'   32 03F0'        STA DCR         ;STORE IT
00BB'   C3 0023'        JMP LOP         ;GO TO MODE 1
00BE'   CD 016B'    A2..:   CALL INV    ;WRITE ERROR MSG
00C1'   C3 0094'        JMP ACR         ;TRY AGAIN
                ;
                ;DETERMINE WHETHER COMMUNICATION WILL
                ;TAKE PLACE IN HALF- OR FULL-DUPLEX MODE.
                ;
00C4'   E5      DPX:    PUSH H          ;SAVE THE TEXT POINTER
00C5'   21 03A3'        LXI H,DPT       ;LOAD TEXT POINTER
00C8'   CD 017D'        CALL WRT        ;WRITE THE STRING
00CB'   E1              POP H           ;GET THE TEXT POINTER
00CC'   CD F003         CALL CCF        ;GET THE CONSOLE CHAR
00CF'   E65F            ANI 5FH         ;CONV. TO UC/NP
00D1'   CD 0374'        CALL SPW        ;WRITE IT
00D4'   FE48            CPI 48H         ;IS IT AN H?
00D6'   CA 00E4'        JZ D1..         ;IF YES, LOAD AN H
00D9'   FE46            CPI 46H         ;IS IT AN F?
00DB'   CA 00EA'        JZ D2..         ;IF YES, LOAD AN F
00DE'   CD 016B'        CALL INV        ;ELSE, WRITE ERROR MSG
00E1'   C3 00C4'        JMP DPX         ;AND TRY AGAIN
00E4'   32 03EE'    D1..:   STA DPL     ;STORE IT
00E7'   C3 0023'        JMP LOP         ;GO TO MODE 1
                ;
                ;STORE THE FDX COMMAND & SET SEND MODE BYTE
                ;TO 'AUTO-SEND'.
                ;
00EA'   32 03EE'    D2..:   STA DPL     ;STORE IT
00ED'   3E41            MVI A,41H       ;LOAD AN A IN A
00EF'   32 03EF'        STA AUT         ;STORE IT
00F2'   C3 0023'        JMP LOP         ;GO TO MODE 1
                ;
                ;DETERMINE IF TEXT WILL BE STORED (IN RECEIVE
                ;MODE) IN 'NORMAL' (CONTROL CHARS EXCLUDED)
                ;OR IN 'TRANSPARENT' (ALL CHARS STORED)
                ;MODE.
                ;
00F5'   E5      RMM:    PUSH H          ;SAVE THE TEXT POINTER
00F6'   21 03AD'        LXI H,RMT       ;LOAD TEXT ADDR
00F9'   CD 017D'        CALL WRT        ;WRITE THE STRING
00FC'   E1              POP H           ;GET THE TEXT POINTER
0176'   CD 0362'        CALL CRF        ;WRITE A LF/CR
0179'   CD 0362'        CALL CRF        ;ONE MORE, PLEASE
017C'   C9              RET             ;TRY AGAIN
                ;
                ;WRITE MODE 1 OPTION PROMPTS.
                ;
017D'   0600A   WRT:    MVI B,10        ;LOAD THE COUNTER
017F'   4E      L1..:   MOV C,M         ;READY TO WRITE
0180'   23              INX H           ;INCREMENT THE POINTER
0181'   05              DCR B           ;DECREMENT THE COUNTER
0182'   CD F009         CALL COT        ;WRITE IT
0185'   78              MOV A,B         ;READY TO COUNT
0186'   FE00            CPI 0           ;IS IT 0 YET?
0188'   C2 017F'        JNZ L1..        ;ELSE, TRY AGAIN
018B'   C9              RET             ;ELSE, CONTINUE
                ;
                ;*****************************************
                ;
                ;           *** MODE 2 COMMAND LOOP ***
                ;
                ;ISSUE A PROMPT AND GO TO MODE 2
                ;
018C'   CD 0362'    SNDT:   CALL CRF    ;WRITE A LF/CR
018F'   0E53            MVI C,53H       ;LOAD PROMPT IN C
0191'   CD F009         CALL COT        ;WRITE IT
0194'   CD 0362'        CALL CRF        ;WRITE A LF/CR
                ;
                ;THE MODEM INPUT LOOP
                ;
0197'   DB72    SND:    IN MST          ;GET MODEM STATUS BYTE
0199'   E601            ANI MSM         ;SAVE STATUS BIT
019B'   CA 01A8'        JZ S1..         ;NOTHING?  TRY CONSOLE
019E'   DB73            IN MOD          ;IF YES, GET INPUT BYTE
01A0'   E67F            ANI 7FH         ;AND OFF PARITY
01A2'   CD 0374'        CALL SPW        ;WRITE IT
01A5'   C3 0197'        JMP SND         ;CHECK AGAIN
                ;
                ;THE MODE 2 COMMAND LOOP
                ;
01A8'   CD F012     S1..:   CALL CSC    ;CHECK CONSOLE STATUS
01AB'   C2 0197'        JNZ SND         ;IF NOTHING, CHECK MODEM
01AE'   CD F003         CALL CCF        ;GET CHAR
01B1'   E67F            ANI 7FH         ;AND OFF PARITY
01B3'   F5              PUSH PSW        ;SAVE A & FLAGS
01B4'   DB72    S2..:   IN MST          ;GET MODEM STATUS
01B6'   E602            ANI MSK         ;SAVE STATUS BIT
01B8'   CA 01B4'        JZ S2..         ;LOOP UNTIL READY
01BB'   F1              POP PSW         ;GET A & FLAGS
01BC'   FE1E            CPI 1EH         ;IS IT A CTR-SHFT-N?
01BE'   CA 0023'        JZ LOP          ;GO TO MODE 1
01C1'   FE1C            CPI 1CH         ;IS IT A 'CLR'?
```

```
00FD'   CD F003          CALL CCF        ;GET CONSOLE CHAR
0100'   E65F             ANI 5FH         ;CONV. TO UC/NP
0102'   CD 0374'         CALL SPW        ;WRITE IT
0105'   FE54             CPI 54H         ;IS IT A T?
0107'   CA 0115'         JZ M1..         ;IF YES, LOAD A T
010A'   FE4E             CPI 4EH         ;IS IT AN N?
010C'   CA 0115'         JZ M1..         ;IF YES, LOAD AN N
010F'   CD 016B'         CALL INV        ;ELSE, WRITE ERROR MSG
0112'   C3 00F5'         JMP RMM         ;AND TRY AGAIN
0115'   32 03ED'  M1..:  STA DMA         ;STORE IT
0118'   C3 0023'         JMP LOP         ;GO TO MODE 1
                ;
                ;DISPLAY THE COMMAND CONFIGURATION.
                ;
011B'   E5       DCC:    PUSH H          ;SAVE TEXT POINTER
011C'   21 0385'         LXI H,CSA       ;LOAD TEXT ADDR
011F'   CD 017D'         CALL WRT        ;WRITE IT
0122'   3A 03EF'         LDA AUT         ;GET AUTO-SEND CHAR
0125'   4F               MOV C,A         ;PUT CHAR IN C
0126'   CD F009          CALL COT        ;WRITE IT
0129'   CD 0362'         CALL CRF        ;WRITE A LF/CR
012C'   21 038F'         LXI H,CRT       ;LOAD TEXT ADDR
012F'   CD 017D'         CALL WRT        ;WRITE IT
0132'   3A 03F0'         LDA DCR         ;GET EOL CHAR
0135'   FE0D             CPI 0DH         ;IS IT A CR?
0137'   C2 0142'         JNZ G1..        ;ELSE, WRITE A D
013A'   0E43             MVI C,43H       ;IF YES, LOAD A C
013C'   CD F009          CALL COT        ;WRITE IT
013F'   C3 0147'         JMP G2..        ;THEN CONTINUE
0142'   0E44     G1..:   MVI C,44H       ;LOAD A D
0144'   CD F009          CALL COT        ;WRITE IT
0147'   CD 0362'  G2..:  CALL CRF        ;WRITE A LF/CR
014A'   21 03A3'         LXI H, DPT      ;LOAD TEXT ADDR
014D'   CD 017D'         CALL WRT        ;WRITE IT
0150'   3A 03EE'         LDA DPL         ;GET DPLX CHAR
0153'   4F               MOV C,A         ;PUT CHAR IN C
0154'   CD F009          CALL COT        ;WRITE IT
0157'   CD 0362'         CALL CRF        ;WRITE A LF/CR
015A'   21 03AD'         LXI H,RMT       ;LOAD TEXT ADDR
015D'   CD 017D'         CALL WRT        ;WRITE IT
0160'   3A 03ED'         LDA DMA         ;GET MODE CHAR
0163'   4F               MOV C,A         ;PUT CHAR IN C
0164'   CD F009          CALL COT        ;WRITE IT
0167'   E1               POP H           ;GET TEXT POINTER
0168'   C3 0023'         JMP LOP         ;GO TO MODE 1
                ;
                ;PRINT AN ERROR MESSAGE WHEN THE OPERATOR
                ;ENTERS AN INVALID CHARACTER IN MODE 1.
                ;
016B'   CD 0362'  INV:   CALL CRF        ;WRITE A LF/CR
016E'   E5               PUSH H          ;SAVE TEXT POINTER
016F'   21 0399'         LXI H,INT       ;LOAD TEXT ADDRESS
0172'   CD 017D'         CALL WRT        ;WRITE THE STRING
0175'   E1               POP H           ;GET TEXT POINTER
```

```
01C3'   CA 01E2'         JZ XMT          ;SEND SOME TEXT
01C6'   FE12             CPI 12H         ;IS IT A CTR-R?
01C8'   CA 02C5'         JZ RCVT         ;GO TO MODE 3
01CB'   FE14             CPI 14H         ;IS IT A CTR-T?
01CD'   CA 0297'         JZ TS0          ;CALL LOGON #1
01D0'   FE19             CPI 19H         ;IS IY A CTR-T?
01D2'   CA 02A2'         JZ TS0          ;CALL LOGON #2
01D5'   FE0D             CPI 0DH         ;IS IT A CR?
01D7'   CC 033F'         CZ DEF          ;IF YES, CALL EOL BYTE
01DA'   D373             OUT MOD         ;SEND CONSOLE CHAR
01DC'   CD 0343'         CALL SPC        ;WRITE IT
01DF'   C3 0197'         JMP SND         ;CHECK THE MODEM AGAIN
                ;
                ;SEND BUFFER ON COMMAND IN MODE 2
                ;
                ;FIRST, CHECK TO SEE IF WE'RE AT THE
                ;BEGINNING OF THE BUFFER.  IF YES,
                ;SKIP THE INITIAL PAD CHAR.
                ;
01E2'   7C       XMT:    MOV A,H         ;PUT CONTENTS OF H IN A
01E3'   85               ADD L           ;ADD CONTENTS OF L TO A
01E4'   FE01             CPI 1           ;DO THEY TOTAL 1?
01E6'   C2 01EA'         JNZ Y1..        ;ELSE, CONTINUE
01E9'   2C               INR L           ;ELSE, INCREMENT L
                ;
                ;THE BASIC TRANSMIT LOOP: MODEM AND CON-
                ;SOLE STATUS BYTES ARE CHECKED TO PROVIDE
                ;EXITS WHEN NECESSARY.
                ;
01EA'   DB72     Y1..:   IN MST          ;GET MODEM STATUS BYTE
01EC'   E601             ANI MSM         ;GET INPUT STATUS BIT
01EE'   CA 01F8'         JZ Y2..         ;NOTHING?  TRY CONSOLE
01F1'   DB73             IN MOD          ;IF YES, GET INPUT BYTE
01F3'   E67F             ANI 7FH         ;AND OFF PARITY
01F5'   CD 0374'         CALL SPW        ;WRITE IT
01F8'   C3 01EA'         JMP Y1..        ;CHECK AGAIN
01FB'   CD F012  Y2..:   CALL CSC        ;CHECK CONSOLE STATUS
01FE'   CA 0197'         JZ SND          ;IF DATA, CHECK IT
0201'   DB72             IN MST          ;GET MODEM STATUS BYTE
0203'   E602             ANI MSK         ;GET OUTPUT STATUS BIT
0205'   CA 01EA'         JZ Y1..         ;LOOP UNTIL READY
0208'   7E               MOV A,M         ;GET CHAR
0209'   23               INX H           ;INCREMENT THE POINTER
020A'   FEFF             CPI 0FFH        ;IS IT A PAD CHAR?
020C'   CA 0282'         JZ EOT          ;YES?  WRITE MSG & EXIT
020F'   FE0D             CPI 0DH         ;IS IT A CR?
0211'   CA 021C'         JZ CRO          ;SEND EOL CHAR
0214'   D373             OUT MOD         ;SEND CHAR
0216'   CD 0343'         CALL SPC        ;WRITE IT
0219'   C3 01EA'         JMP Y1..        ;GET THE NEXT CHAR
                ;
                ;SEND A DC-3 OR CR, THEN OBEY ATS COMMAND.
                ;
```

```
021C'   3A 03F0'    CR0:    LDA DCR         ;GET EOL CHAR
021F'   FE0D                CPI 0DH         ;IS IT A CR?
0221'   C2 0234'            JNZ C1••        ;ELSE, SEND A DC-3
0224'   D373                OUT MOD         ;SEND A CR
0226'   3A 03EE'            LDA DPL         ;GET DUPLEX MODE CHAR
0229'   FE46                CPI 46H         ;IS IT AN F?
022B'   CA 0236'            JZ C2••         ;YES?  CHECK ATS COMMAND
022E'   CD 03b2'            CALL CRF        ;ELSE, WRITE A LF/CR
0231'   C3 0236'            JMP C2••        ;THEN CHECK ATS COMMAND
0234'   D373         C1••:   OUT MOD         ;SEND IT
                    ;
                    ;DECIDE IF OPTION IS CONTINUOUS SEND, SEND ON
                    ;COMMAND, OR SEND ON CUE.
                    ;
0236'   3A 03FF'    C2••:   LDA AUT         ;GET AUTO SEND BYTE
0239'   FE43                CPI 43H         ;IS IT A C?
023B'   CA 01EA'            JZ Y1••         ;YES?  CONTINUOUS SEND
023E'   FE1C                CPI 1CH         ;IS IT A 'CLR'?
0240'   CA 0197'            JZ SND          ;YES?  SEND ON COMMAND
                    ;
                    ;SEND ON EOL CUE.
                    ;
0243'   CD F012     C3••:   CALL CSC        ;A WAY OUT IF THE
0246'   CA 0197'            JZ SND          ;DATA IS GARBLED
0249'   DB72                IN MST          ;GET MODEM STATUS BYTE
024B'   E601                ANI MSM         ;SAVE STATUS BIT
024D'   CA 0243'            JZ C3••         ;IF NOTHING, TRY AGAIN
0250'   DB73                IN MOD          ;GET DATA
0252'   E67F                ANI 7FH         ;AND OFF PARITY
0254'   CD 0374'            CALL SPW        ;WRITE IT
0257'   FE0D                CPI 0DH         ;IS IT A CR?
0259'   CA 025F'            JZ C4••         ;YES?  GO TO TIMER
025C'   C3 0243'            JMP C3••        ;ELSE, WAIT SOME MORE
                    ;
                    ;WHEN A CR HAS BEEN RECEIVED, THIS TIMING
                    ;LOOP DISPLAYS ANY ADDITIONAL EOL CHAR-
                    ;ACTERS AND RETURNS TO THE 'XMT' LOOP,
                    ;WHICH SENDS THE NEXT LINE.
                    ;
025F'   01 4000     C4••:   LXI B,4000H     ;LOAD THE COUNTER
0262'   0B          C5••:   DCX B           ;DECREMENT THE COUNTER
0263'   DB72                IN MST          ;GET MODEM STATUS BYTE
0265'   E601                ANI MSM         ;SAVE STATUS BIT
0267'   C2 0273'            JNZ C6••        ;IF DATA, WRITE IT
026A'   78                  MOV A,B         ;ELSE, READY COUNT
026B'   FE00                CPI 0           ;IS IT ZERO YET?
026D'   C2 0262'            JNZ C5••        ;ELSE, LOOP AGAIN
0270'   C3 01EA'            JMP Y1••        ;YES?  SEND NEXT LINE
0273'   DB73         C6••:   IN MOD          ;GET INPUT BYTE
0275'   E67F                ANI 7FH         ;AND OFF PARITY
0277'   FE13                CPI 13H         ;IS IT A DC-3?
0279'   CA 025F'            JZ C4••         ;IF YES, IGNORE IT
027C'   CD 0374'            CALL SPW        ;WRITE IT
027F'   C3 025F'            JMP C4••        ;LOOP AGAIN
                    ;
                    ;PRINT A MSG AND RETURN TO THE MODE 2
                    ;COMMAND LOOP WHEN EOT PAD IS FOUND.
                    ;
0282'   E5          EOT:    PUSH H          ;SAVE THE POINTER
0283'   CD 0362'            CALL CRF        ;WRITE A LF/CR
0286'   CD 0362'            CALL CRF        ;ONE MORE, PLEASE
0289'   21 03B7'            LXI H,ETM       ;LOAD MSG ADDRESS
028C'   CD 017D'            CALL WRT        ;WRITE THE STRING
028F'   CD 0362'            CALL CRF        ;WRITE A LF/CR
0292'   E1                  POP H           ;GET POINTER
0293'   23                  INX H           ;INCREMENT H
0294'   C3 0197'            JMP SND         ;GO TO MODE 2
                    ;
                    ;AUTOMATIC LOGON MESSAGES #1 & #2
                    ;
                    ;THE MSG #1 ENTRY POINT
                    ;
0297'   E5          IS0:    PUSH H          ;SAVE THE TEXT POINTER
0298'   21 03C1'            LXI H,IST       ;LOAD TEXT ADDR
029B'   CD 02AD'            CALL I1••       ;SEND IT
029E'   E1                  POP H           ;GET THE POINTER
029F'   C3 0197'            JMP SND         ;GO TO MODE 2
                    ;
                    ;THE MSG #2 ENTRY POINT
                    ;
02A2'   E5          TS0:    PUSH H          ;SAVE THE TEXT POINTER
02A3'   21 03D7'            LXI H,TST       ;LOAD TEXT ADDR
02A6'   CD 02AD'            CALL I1••       ;SEND IT
02A9'   E1                  POP H           ;GET THE POINTER
02AA'   C3 0197'            JMP SND         ;GO TO MODE 2
02AD'   0616        I1••:   MVI B,22        ;SET THE COUNTER
02AF'   DB72        I2••:   IN MST          ;GET MODEM STATUS BYTE
02B1'   E602                ANI MSK         ;GET OUTPUT STATUS BIT
02B3'   CA 02AF'            JZ I2••         ;LOOP UNTIL READY
02B6'   7E                  MOV A,M         ;GET CHAR
02B7'   23                  INX H           ;INCREMENT THE POINTER
02B8'   05                  DCR B           ;DECREMENT THE COUNTER
02B9'   D373                OUT MOD         ;SEND THE CHAR
02BB'   CD 0343'            CALL SPC        ;WRITE IT
02BE'   78                  MOV A,B         ;READY TO COUNT
02BF'   FE00                CPI 0           ;IS IT 0 YET?
02C1'   C2 02AF'            JNZ I2••        ;ELSE, TRY AGAIN
02C4'   C9                  RET             ;HEAD FOR MODE 2
                    ;
                    ;************************************************
                    ;
                    ;               *** MODE 3 COMMAND LOOP ***
                    ;
                    ;WRITE A PROMPT AND ENTER MODE 3.
                    ;
```

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```
02C5'  CD 0362'   RCVT:   CALL CRF        ;WRITE A LF/CR
02C8'  0E52               MVI C,52H       ;LOAD PROMPT IN C
02CA'  CD F009            CALL COT        ;WRITE IT
02CD'  CD 0362'           CALL CRF        ;WRITE A LF/CR
                          ;
                          ;THE MODE 3 COMMAND LOOP
                          ;
02D0'  36FF               MVI M,0FFH      ;PUT TEXT PAD IN BUFFER
02D2'  23                 INX H           ;INCREMENT POINTER
02D3'  DB72       R1**:   IN MST          ;GET MODEM STATUS.
02D5'  E601               ANI MSM         ;GET STATUS BIT
02D7'  CA 0313'           JZ R2**         ;NOTHING?  CHECK CONSOLE
02DA'  DB73               IN MOD          ;GET MODEM BYTE
02DC'  E67F               ANI 7FH         ;AND OFF PARITY
                          ;
                          ;CHECK RECEIVE MODE: NORMAL OR TRANSPARENT?
                          ;
02DE'  F5                 PUSH PSW        ;SAVE THE CHAR
02DF'  3A 03ED'           LDA DMA         ;GET DEFAULT MODE CHAR
02E2'  FE54               CPI 54H         ;IS IT A T?
02E4'  CA 030D'           JZ R3**         ;YES?  CONTINUE TRANSPAR
ENT
                          ;
                          ;IMPLEMENT NORMAL MODE
                          ;OF TEXT STORAGE
                          ;
02E7'  F1                 POP PSW         ;GET THE CHAR
02E8'  FE0D               CPI 0DH         ;IS IT A CR?
02EA'  CA 030E'           JZ R4**         ;IF YES, CONTINUE
02EQ'  FE0A               CPI 0AH         ;IS IT A LF?
02EF'  CA 030E'           JZ R4**         ;IF YES, CONTINUE
02F2'  FE09               CPI 09H         ;IS IT A HT?
02F4'  CA 030E'           JZ R4**         ;IF YES, CONTINUE
02F7'  FE07               CPI 07H         ;IS IT A BELL?
02F9'  CA 030E'           JZ R4**         ;IF YES, CONTINUE
02FC'  D620               SUI 20H         ;IS IT A CTR CHAR?
02FE'  FA 02D3'           JM R1**         ;IF YES, IGNORE IT
0301'  C620               ADI 20H         ;PUT THE 20 BACK
0303'  D67F               SUI 7FH         ;SUBTRACT HIGH
0305'  F2 02D3'           JP R1**         ;IF YES, IGNORE IT
0308'  C67F               ADI 7FH         ;PUT IT BACK
030A'  C3 030E'           JMP R4**        ;CONTINUE
030D'  F1         R3**:   POP PSW         ;GET THE CHAR
030E'  77         R4**:   MOV M,A         ;PUT IT IN THE BUFFER
030F'  CD 0374'           CALL SPW        ;WRITE IT
0312'  23                 INX H           ;INCREMENT THE POINTER
0313'  CD F012    R2**:   CALL CSC        ;GET CONSOLE STATUS
0316'  C2 02D3'           JNZ R1**        ;NOTHING?  CHECK MODE
0319'  CD F003            CALL CCF        ;FETCH CONSOLE CHAR
031C'  E67F               ANI 7FH         ;AND OFF PARITY
031E'  F5                 PUSH PSW        ;SAVE A & FLAGS
031F'  DB72       R5**:   IN MST          ;GET MODEM OUTP STATUS
0321'  E602               ANI MSK         ;GET STATUS BIT
```

```
036A'  CD F009            CALL COT        ;WRITE IT
036D'  C1                 POP B           ;GET B & C
036E'  C9                 RET             ;RETURN
                          ;
                          ;PREPARE TO WRITE THE
                          ;MODEM CHAR
                          ;
036F'  F1         SPV:    POP PSW         ;ADJUST THE STACK
0370'  DB73               IN MOD          ;GET MODEM BYTE
0372'  E67F               ANI 7FH         ;AND OFF PARITY
                          ;
                          ;WRITE CHAR FROM
                          ;KEYBOARD OR MODEM
                          ;
0374'  4F         SPW:    MOV C,A         ;READY TO WRITE
0375'  F5                 PUSH PSW        ;SAVE THE CHAR
0376'  CD F009            CALL COT        ;WRITE IT
0379'  F1                 POP PSW         ;GET CHAR
037A'  C9                 RET             ;BACK TO WORK
                          ;
                          ;*********************************************
                          ;
                          ;              *** TEXT STORAGE ***
                          ;
037B'                     SON:                    ;'MICROCOM/3'
037B'  4D4943524F                 .ASCII  'MICRO'
0380'  434F4D2F33                 .ASCII  'COM/3'
                          ;
0385'                     CSA:                    ;'SND MODE: '
0385'  534E44204D                 .ASCII  'SND M'
038A'  4F44453A20                 .ASCII  'ODE: '
                          ;
038F'                     CRT:                    ;'EOL CHAR: '
038F'  454F4C2043                 .ASCII  'EOL C'
0394'  4841523A20                 .ASCII  'HAR: '
                          ;
0399'                     INT:                    ;'INVALID OP'
0399'  494E56414C                 .ASCII  'INVAL'
039E'  4944204F50                 .ASCII  'ID OP'
                          ;
03A3'                     DPT:                    ;'F/H DPLX: '
03A3'  462F482044                 .ASCII  'F/H D'
03A8'  504C583A20                 .ASCII  'PLX: '
                          ;
03AD'                     RMT:                    ;'RCV MODE: '
03AD'  524356204D                 .ASCII  'RCV M'
03B2'  4F44453A20                 .ASCII  'ODE: '
                          ;
03B7'                     ETM:                    ;'***EOT*** '
03B7'  2A2A2A454F                 .ASCII  '***EO'
03BC'  542A2A2A20                 .ASCII  'T*** '
                          ;
                          ;LOGON MESSAGE #1
```

```
0323'  CA 031F'          JZ R5••          ;LOOP IF NOT READY
0326'  F1                POP PSW          ;GET A & FLAGS
0327'  FE1E              CPI 1EH          ;IS IT A CTR-SHFT-N?
0329'  CA 0339'          JZ R6••          ;IF YES, GO TO MODE 2
032C'  FE0D              CPI 0DH          ;IS IT A CR?
032E'  CC 033F'          CZ DEF           ;YES?  CALL EOL ROUTINE
0331'  D373              OUT MOD          ;SEND IT
0333'  CD 0343'          CALL SPC         ;WRITE IT
0336'  C3 02D3'          JMP R1••         ;CHECK THE MODEM
                         ;
                         ;PUT PAD AT END OF
                         ;BUFFER AND GO TO MODE 2•
                         ;
0339'  36FF              R6••:  MVI M,0FFH     ;INSERT BUFFER PAD CHAR
033B'  23                INX H            ;INCREMENT POINTER
033C'  C3 018C'          JMP SNDT         ;GO TO MODE 2
                         ;
                         ;*********************************************
                         ;
                         ;              *** MCP UTILITIES ***
                         ;
                         ;GET END-OF-LINE CHAR AND RETURN IT
                         ;
033F'  3A 03F0'          DEF:   LDA DCR        ;GET EOL CHAR
0342'  C9                RET              ;RETURN
                         ;
                         ;CHECK TO FIND WHETHER WE'RE IN HALF-
                         ;OR FULL-DUPLEX MODE•  IF IN 'FULL', WAIT
                         ;FOR CHARACTER TO RETURN FROM HOST BEFORE
                         ;PROCEEDING•
                         ;
0343'  F5                SPC:   PUSH PSW       ;SAVE THE CHAR
0344'  3A 03EE'          LDA DPL          ;GET DUPLEX MODE CHAR
0347'  FE48              CPI 48H          ;IS IT AN H?
0349'  C2 0350'          JNZ P1••         ;ELSE, GO TO TIMER
034C'  F1                POP PSW          ;IF YES, GET THE CHAR
034D'  C3 0374'          JMP SPW          ;WRITE IT
0350'  DB72              P1••:  IN MST         ;GET MODEM STATUS BYTE
0352'  E601              ANI MSM          ;SAVE STATUS BIT
0354'  C2 036F'          JNZ SPV          ;IF DATA, WRITE IT
0357'  CD F012           CALL CSC         ;CHECK CONSOLE STATUS
035A'  C2 0360'          JNZ P2••         ;IF DATA, GET IT
035D'  C3 0350'          JMP P1••         ;ELSE, LOOP AGAIN
0360'  F1                P2••:  POP PSW        ;ADJUST THE STACK
0361'  C9                RET              ;GET THE DATA
                         ;
                         ;CARRIAGE RETURN/LINE FEED
                         ;
0362'  C5                CRF:   PUSH B         ;SAVE B & C
0363'  0E0D              MVI C,0DH        ;PUT CR IN C
0365'  CD F009           CALL COT         ;WRITE IT
0368'  0E0A              MVI C,0AH        ;PUT LF IN C
```

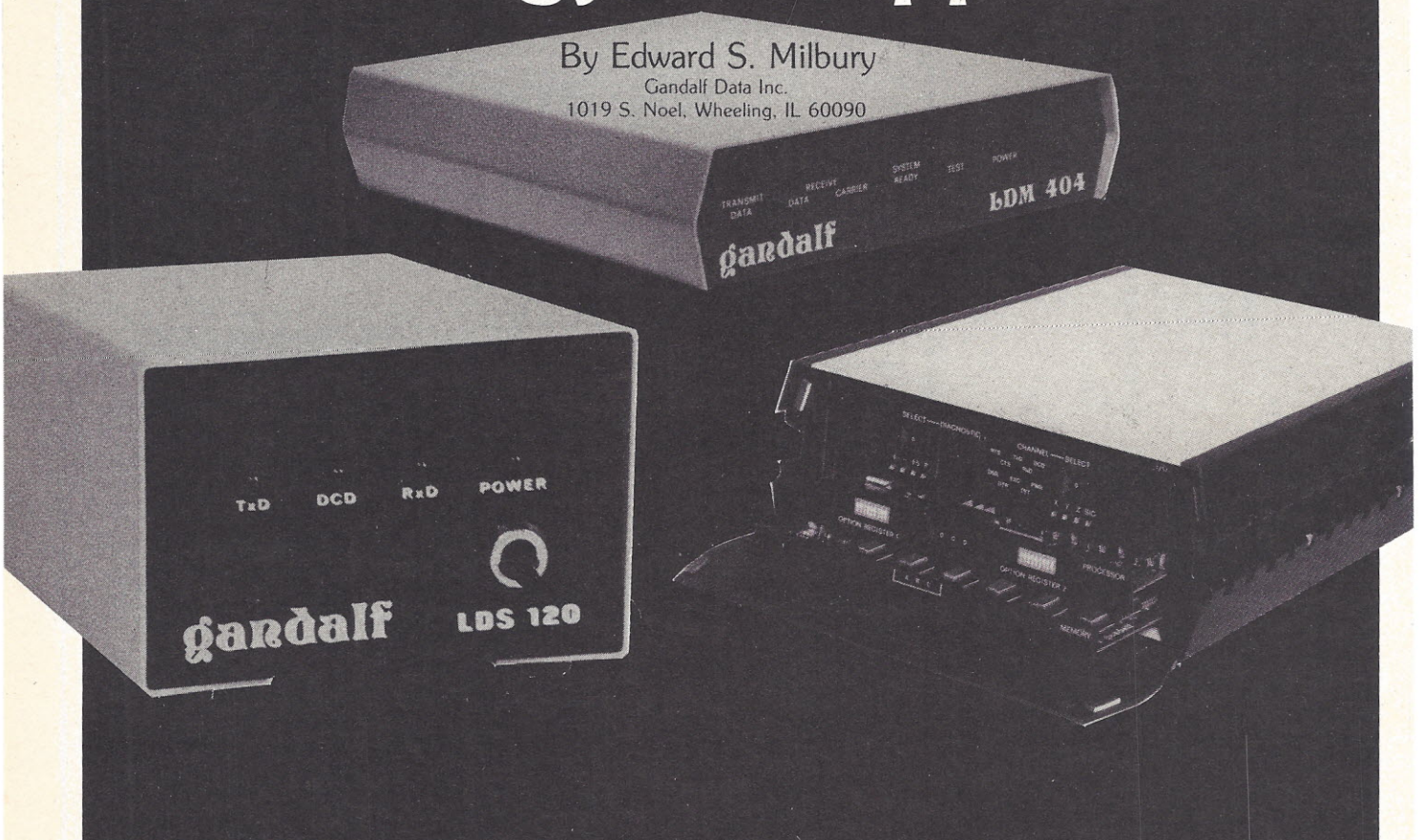
```
                         ;
03C1'                    IST:          ;'CLOGON MSG #1]       [DC-3]'
03C1'  5B4C4F474F                 •ASCII •CLOGO•
03C6'  4E204D5347                 •ASCII •N MSG•
03CB'  2023315D20                 •ASCII • #1] •
03D0'  2020202020                 •ASCII •     •
03D5'  2013                       •ASCII • •
                         ;LOGON MESSAGE #2
                         ;
03D7'                    TST:          ;'CLOGON MSG #2]       [DC-3]'
03D7'  5B4C4F474F                 •ASCII •CLOGO•
03DC'  4E204D5347                 •ASCII •N MSG•
03E1'  2023325D20                 •ASCII • #2] •
03E6'  2020202020                 •ASCII •     •
03EB'  2013                       •ASCII • •
                         ;
                         ;*********************************************
                         ;
                         ;END OF PROGRAM
                         ;
                         •END
```

+++++ SYMBOL TABLE +++++

A1••	00B1'	A2••	00BE'	ACR	0094'
ATS	0041	AUT	03EF'	C1••	0234'
C2••	0236'	C3••	0243'	C4••	025F'
C5••	0262'	C6••	0273'	CAS	0069'
CCF	F003	COT	F009	CRD	0013
CRF	0362'	CRO	021C'	CRT	038F'
CSA	0385'	CSC	F012	D1••	00E4'
D2••	00EA'	DCC	011B'	DCR	03F0'
DEF	033F'	DMA	03ED'	DMC	004E
DPB	0048	DPL	03EE'	DPT	03A3'
DPX	00C4'	EOT	0282'	ETM	03B7'
G1••	0142'	G2••	0147'	I1••	02AD'
I2••	02AF'	INT	0399'	INV	0168'
ISO	0297'	IST	03C1'	L1••	017F'
LOP	0023'	M1••	0115'	MOD	0073
MON	F01E	MSK	0002	MSM	0001
MST	0072	P1••	0350'	P2••	0360'
R1••	02D3'	R2••	0313'	R3••	030D'
R4••	030E'	R5••	031F'	R6••	0339'
RCVT	02C5'	RMM	00F5'	RMT	03AD'
S1••	0148'	S2••	0184'	SND	0197'
SNDT	018C'	SON	0378'	SPC	0343'
SPV	036F'	SPW	0374'	STK	0402'
STR	0000'	TPT	0100	TSO	02A2'
TST	03D7'	VST	03ED'	WRT	017D'
X1••	008E'	XMT	01E2'	Y1••	01E4'
Y2••	01F8'				

Data Modems: Technology and Applications

By Edward S. Milbury
Gandalf Data Inc.
1019 S. Noel, Wheeling, IL 60090



PHOTOS (left to right) An asynchronous short-haul, operating at 0-9600 baud up to five miles on telco metallic circuits; a medium-distance modem, operating up to 50 miles on voice-frequency lines at 4800 bps; a 9600 bps over unconditioned voice-frequency telephone line with no distance limit.

Remote access to data processing facilities requires that data in digitized format be transferred over some form of communication facility in a highly efficient and accurate manner. The current trend towards distributed processing and on-line remote access to data processing resources has given rise to a wide variety of data modems to accomplish this data transfer.

MODEM FUNCTION

The term modem is derived from the terminology modulator/demodulator, which refers to the basic function of modulating some sort of "carrier" signal with the digital information to be transmitted. This carrier signal containing the digital information is provided to the common carrier circuit (usually a normal telephone channel) for transport to some distant location.

At that point a complementary modem is used to extract the digital signal from the carrier, and the digital signal is presented to the receiving computer equipment as if the communication function were totally transparent. The function of the modem, therefore, is to accomplish this data transfer with no degradation in accuracy of the transferred data.

While this seems simple enough in concept, the wide variety of communication facilities, speed requirements, malfunction diagnostic requirements, and economic factors has given rise to a large industry to optimize the various solutions to this problem. This equipment can best be subdivided into the following categories relative to classification of modem usage:

Short-haul Data Modem Equipment
Low-speed Asynchronous Modems
High-speed Synchronous Modems
Special Application Modems

SHORT-HAUL MODEMS

While a recent innovation in modem applications, the "Short-haul" modem has come into popular usage in the last few years due to the availability of appropriate telephone facilities and technological innovations recently introduced. This class of device takes advantage of the use of purely metallic cable facilities to permit very high-speed data transfers with a relatively low equipment cost. For example, asynchronous data (i.e. data characters framed by start/stop bits) can be transferred up to five miles at speeds of 9600 bits per second using very inexpensive data modems.

While somewhat more sophisticated in terms of modem electronics, short-hauls can also transfer data on a synchronous basis (i.e. data blocks without start/stop framing but with timing provided to the terminal equipment by the modem). This synchronous mode of transmission is often used in state-of-the-art terminal equipment because it has more efficient data transfer. Units in this class sell in the range of $300-$600 per modem end.

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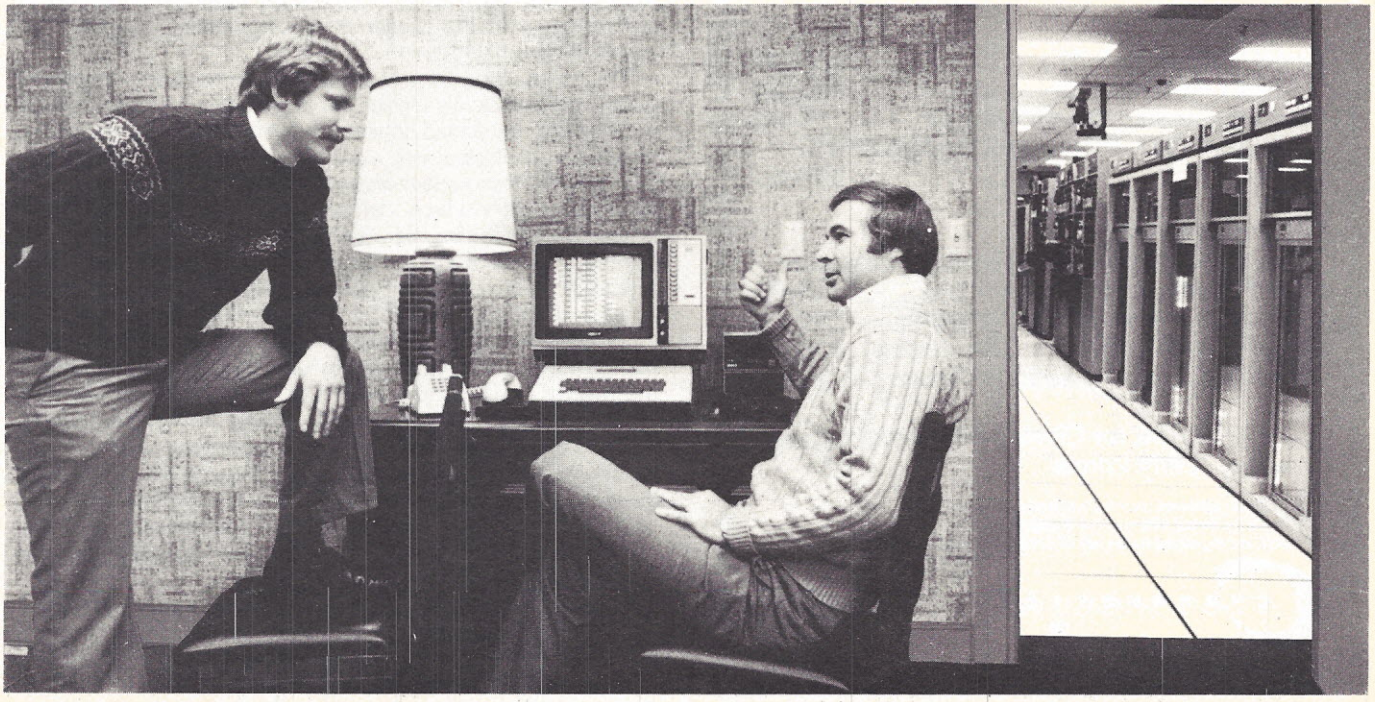

". . . but the really impressive stuff is in the back room."

LOW-SPEED ASYNCHRONOUS

Terminal devices which involve highly interactive keyboard operation generally require relatively low data rates due to the input/output limitations of the operator. This has led to a technology whereby the low transfer rates permit low cost modem design, with typical baud rates of 300 or 1200 baud maximum. At these rates the typical telephone line is very efficient for doing the transfer, and the modem technology requires minimal electronic technology.

Further, at these speeds, the desirable feature of acoustically coupling the terminal device to a telephone handset is feasible, again due to the simplification permitted by low data rate transfers. This class of low-speed modem is generally available as an option to terminal and personal computing equipment and units of various manufacturers can generally communicate with one another due to standardization of the carrier modulation techniques. Units in this range sell for $400 to $900 per end.

HIGH-SPEED MODEMS

When the application requires large volumes of data transfer between devices (e.g. CPU-to-CPU or tape-to-tape) it becomes economically desirable to make maximum use of the leased telephone facilities. To do this, rather sophisticated modem technology is utilized which can transfer very high-speed data in the same bandwidth which is used for the 300 or 1200 baud modems. State-of-the-art technology today permits up to 9600 bps in a typical 3000 hertz bandwidth voice channel with no limitation on the distance between the transmitting and receiving stations.

At these data rates the requirement for sophisticated diagnostic facilities in the data sets is commonplace and generally results in modems which are complex and sophisticated. Standard operating rates in this class of equipment are 2400, 4800, or 9600 bits per second with price tags ranging from $2000 to $7000 per end.

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SPECIALTY MODEMS

There are other types of modem devices that are not as widely used, but are necessary in some applications. Higher speed modems operating at 50,000 bits per second or higher are often used to support CPU-to-CPU data transfers, or transfers between special purpose terminals and the central processor (for example, a geological data collection terminal). Other applications require the conversion of asynchronous character formats prior to transfer over synchronous data links, resulting in higher asynchronous traffic transfers than would normally be possible.

In addition to traditional modem transfers from point to point, numerous varieties of networking configurations require modems that operate in multi-point modes (i.e. one master modem communicating with multiple slave units on a time-shared basis), modems which operate on private lines with back-up operation on dial facilities, and so on. Virtually every potential application can be met with off-the-shelf available modem hardware today.

WHAT DO I NEED?

The usual approach to this problem is to attempt to define the minimum requirements of the application, determine the desired information transfer rate given the limitations of the terminal hardware involved, and examine the restrictions in cost versus performance. Once it is determined whether the lower cost approaches are feasible, the user should decide whether to procure the equipment on a rental basis from the common carrier supplying the transmission facility, or whether to gain the long term cost advantages and wider variety of hardware selection possible from an independent supplier of communication equipment.

This choice is often somewhat dependent on the economic considerations as well as experience of the local common carrier. While the local phone company is a relatively convenient and painless approach to data communication, the independent manufacturer makes it his business to specialize in data communications with a level of sophistication and pricing which is very competitive.

TECHNOLOGY TRENDS

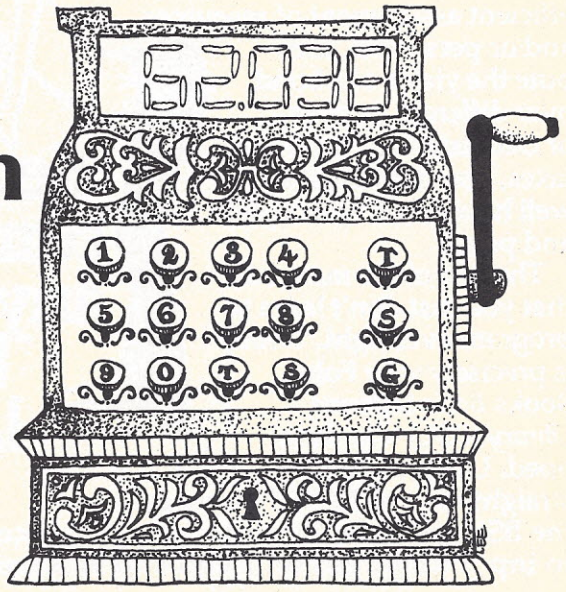
What is happening today in the manufacturers' development labs and where is data communications going? Due to the nature of our economy today, it appears that the cost of the communication facility increases while the cost of the equivalent modem declines due to the advances in electronic technology and the presence of competition among independent manufacturers.

This is resulting in a continued trend towards equipment which more efficiently utilizes the existing telephone plant facilities through increased speed, increased accuracy, and more innovative hardware. For example, with the recent developments in microprocessor technology, manufacturers are offering multiplexers which combine multiple terminals into a single modem for transfer over the telephone line. By buffering the outputs of the terminals under control of the microprocessor, the usage of any given modem facility increases by a factor of perhaps ten times over previous technology.

Other available equipment increases the range of short-haul modems from what was previously a ten-mile limitation to upwards of 100 miles while still maintaining the low cost of the modem equipment itself. In the area of high-speed technology, recent innovations in updated modulation technology made possible by very high-speed processor design has made cost reduction possible while simultaneously obtaining performance improvements. Another innovation, the "modem-on-a-chip," has recently been implemented for some of the simpler modem devices.

In general, modems are becoming less expensive while taking advantage of new technology to improve operating performance. This, combined with the proliferation of the distributed terminals, provides a bright outlook for the modem industry and its customer base over the upcoming years.□

How to Buy an Accounts Receivable System



By Rocky Smolin

If you've spent any time at all as either a user or investigator of small computer systems, by now you are suitably impressed with both the lack of reputable programs available and the difficulty of designing programming for your own business applications. There are plenty of games on the market, and lots of neat programs to be copied out of magazines.

But let's face it. If you're going to plunk down from five to fifteen thousand dollars for a computer system with a couple of disk drives and a printer, you want it to do more than play a hot game of chess. In fact, what you really want to know is: how can I use my computer in my business to make life a little easier and maybe increase my bottom line a bit?

No matter what application you have in mind for your business — an attorney time-keeping system for the legal beagles or a personnel database for you headhunters — eventually you're going to want the computer to take over some of the accounting functions of your business.

And why not? Accounting was one of the first areas of business invaded by computers back in the bad old days of data processing, and for very good reasons. It is a painstaking repetitive task requiring absolute accuracy. It affects both the cash in and the cash out of your business and hence, timeliness is critical. All the sales in the world can't help a business which is consistently late in its billing. Mess up on your payables and your suppliers start to dry up.

This brings us to the purpose of this article. Accounts receivable forms the nucleus of any computerized accounting system. Since it has such a material effect on the health and welfare of your business, it is important to understand how this system should work on a computer and what you should expect (both the good news and the bad news) from it.

There are a lot of accounts receivable packages available today ranging from the sublime to the ridiculous. The biggest problem with almost all business software is that it was either written by a business person, in which case it incorporates all the correct accounting principles in a system which operates with the grace and ease of a three-legged St. Bernard, or it was written by a computer whiz with no business experience, in which case its elegance and operational simplicity are overshadowed only by its inability to do the job correctly and completely.

A well-designed accounts receivable package will have three files associated with it: the customer information file, the master invoice file, and the detail invoice file. The customer master record should look something like this:

A. Customer number or identifier (to link it to the other two files)
B. Customer name
C. Billing (and perhaps shipping) address
D. Credit limit
E. Date of last payment
F. Total dollar amount of unpaid invoices

The invoice master record should contain as a minimum:

A. Invoice number (to link to the Detail File)
B. Customer number (to link to the Customer Master File)
C. Date of billing (for aged receivables report)
D. Total amount of invoice
E. Total amount received to date

TYPICAL RECORD LAYOUTS

1. CUSTOMER MASTER RECORD

CUSTOMER NUMBER	NAME	ADDRESS	CREDIT LIMIT	DATE LAST PAYMENT	TOTAL $ AMOUNT UNPAID

2. INVOICE MASTER RECORD

INVOICE NUMBER	CUSTOMER NUMBER	BILLING DATE	INVOICE TOTAL	TOTAL PAYMENTS TO DATE	FREIGHT AMOUNT	TAX AMOUNT

3. INVOICE DETAIL RECORD

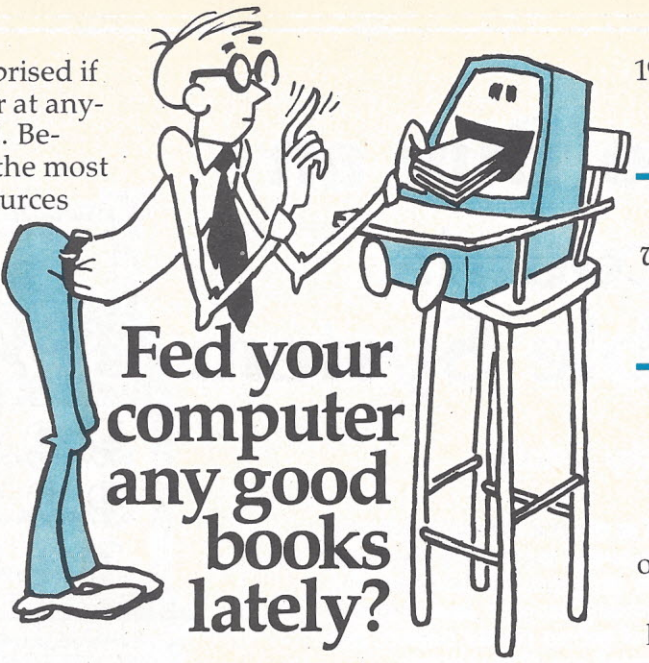
INVOICE NUMBER	PART NUMBER	DESCRIPTION (MAY OR MAY NOT BE PRESENT)	QUANTITY	UNIT PRICE

A Detail Invoice record should contain the line items to appear on the invoice:

A. Invoice number (to link to the Invoice Master File)
B. Part number or identifier or description (a really sophisticated system will pull the description from a separate file based on the part number or even from your inventory system).
C. Quantity
D. Unit price

For each line item on the invoice there will be one record in the file. For each invoice there will be one record in the Invoice Master file. For each of your customers there will be one record in the Customer Master file.

A file is a collection of records, each of which has the same format or contains the same categories of information, even though the content of those categories will vary from record to record. If you put the telephone book on a disk file, each



Fed your computer any good books lately?

If you haven't, we'd be surprised if you're using your computer at anywhere near its full potential. Because if it won't determine the most efficient assignment of resources and/or personnel, compute the yields of a bond over different periods, or calculate your income taxes, you might just as well have stuck with a pad and pencil.

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Mortgage • Makes a comparison of mortgage terms.
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T-Distribution • Calculates normal and T-distributions.
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Integers • Computes integers as the sum of other integers.
Logic • Determines conclusions from logic statements.
Primes • Factors numbers into their primes.
Quadrac • Solves quadratic equations.
Regression 2 • Calculates linear regressions.
Roulette • Computerized "wheel of fortune" plays roulette.
Stat 10 • Calculates quantities for two groups of paired data.
Stat 11 • Computes sample statistics.
Top • Computes cost for surfacing road or driveway.
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Appendix B: ***Statement Conversion Algorithms***

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entry in the book would be one record (name, address, and telephone number being the categories of information). All the entries together on the disk would be a file.

In addition to these files, some systems will incorporate a temporary transaction file. There are two ways to approach the input and processing of information to an accounts receivable system: one is to process each transaction as it is entered (known as 'on-line' processing), the other is to store all the data that is entered in a temporary or holding file until the input is complete. Then another program updates the files on the disk (the ever popular 'batch-processing' mode). The two methods represent a major philosophical difference in the design of business systems.

OUTPUT

Now that you have some idea of what the system should be storing, let's look at some of the things you'll want to see come out of your system.

Invoice printing. Some very simple systems will not do this for you. That means entering the data twice: once into the computer for its information and once on the invoice with all the attendant possibility for error. Considering the amount of money and effort you will expend integrating this computer system into your business, it hardly seems worth your while to have it do half the job. However, the system you choose must be flexible enough to print on your invoice forms. If not, you'll either have to buy the forms the programs are set up to print on or you'll have to modify the programs yourself.

Printed reports. As a minimum you'll want to see 1) an aged receivables report, 2) a current customer status report including all the information in the customer master file followed by a list of outstanding invoices from the invoice master file for each customer.

Reports on the screen. Any accounts receivable system worth its salt will allow you to get instant answers on the CRT about customers, how much they owe you, credit status and limits, outstanding invoices, etc.

Audit trails. Audit trails are listings from the printer which show (or should show) every bit of information entered into the computer, and/or information already in the files which has been modified by some operator input (altering credit status, for instance). They were originally implemented on large systems for security purposes, to prevent fraud and ripoffs, and to provide a means for the auditors to trace back all of the activity on an accounting system.

Although security should be a concern of every business system user, the primary purpose of audit trails on small systems is quite different. I have never worked on any (repeat, any) computer which did not eventually crap out, causing the destruction of one or more data files (sometimes even a disk drive). I have never seen a software system that was truly 'fool' proof. Somebody always goofs up eventually with a resultant loss of valuable data. And finally, of course, data can always be entered incorrectly.

Although all prudent users of computers should be making regular backup copies of the data files in case of hardware, software, or procedural failures, it will happen sooner or later that your backup files will fail, an irate customer will contest the amount of an invoice, unpaid invoices will be entered as paid, or someone will spill a coke in your disk drives. Any of a thousand unlikely occurrences will occur.

At that time you will want to be able to go back and see exactly what was input into the system, and the audit trails are the only way to do this. Even in the event of a catastrophic failure of your hardware, the last complete status report, coupled with listings of all activity since the date of the status report will allow you to reconstruct your receivables manually, and hence, maintain your billing and cash flow.

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Dedicated Record Sorting: Sorted files are re-written to disk. The sort may be in either ascending or descending order. Uses the FAST Shell-Metzner sorting algorithm.

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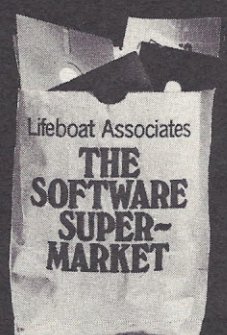

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Now there seems to be a prevailing philosophy among designers of business software for very small business systems that this sort of feature is an unnecessary extravagance. It complicates the programming and operation of the system, and is unjustified in view of the small database. Don't you believe it. Microprocessors are powerful enough (given some good software) to handle databases containing millions of bytes of information, hundreds of customers, and thousands of invoices. If the system you are considering does not offer comprehensive audit trails, be prepared for disaster by implementing a backup plan of your own *before* you computerize.

As mentioned above, the backup and file protection are critical procedures in any computer system. Since this topic falls mainly outside the area of programming and in the area of the user's own procedures, most vendors leave this topic pretty much to the discretion of the individual user. A top-notch business system will have both a section in the documentation on back up and security procedures, and prompts on the screen telling the operator how and when to do the backups. It shows a concern for the user by the writers of the system, and a pragmatic realization that their market is comprised mainly of unsophisticated users who require this kind of advice and training in order to be successful integrating their computer into their business.

Input considerations are fairly easy to evaluate — after you have used the system for a few hours (see section below on how to shop). The screen layouts and input procedures should be 'human engineered.' That is, the instructions which appear on the screen and the input procedures to be followed should be obvious without having to repeatedly refer to the instruction manual. The prompts should guide you through the procedure, correcting you when you make a mistake, providing help when it is needed.

One of the handiest utilities ever invented was the *sort program.* It enables you to look at the information in your files in different ways by sorting the file on one or more of the fields in a record. For example, with a good user-oriented sort program, you can get reports from your accounts receivable system in alphabetical order by customer, by date of last billing, by date last paid, in ascending or descending order to total outstanding invoices, in short, by any field in the record.

Sort the invoice detail file by part number and list it on the printer, and you'll have a sales history by part number. A sort of this file by part number and then by customer number within the part number will show you who is buying the most of a given part. Sort it first by customer number and then by part number and you'll know what each customer buys the most of.

Most business packages do not have a flexible sort program built in. However, good sorting programs are becoming available for more and more machines. They do require some knowledge of programming to implement. The output from the sort program is generally another disk file with the records reorganized in a new sequence. To get those records off the disk and onto a printer in a format that makes sense to you requires you to write a report program. However, if you are willing to take the time to learn to do this (and, by the way, have some real fun with your computer) a sort program will be a valuable addition to your software library.

Parameters — maxima and minima. I only use these terms because they sound so impressive. Actually what I'm talking about here is simple: does the design of the software and the capacities of the hardware allow you to do the job you want to do? The important considerations are:

1. How many customers can be stored
2. What is the maximum number of transactions that can be input (both master invoice records and detail invoice records)

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Software with Manual / Manual Alone

DIGITAL RESEARCH

☐ **CP/M FLOPPY DISKETTE OPERATING SYSTEM** — Packages supplied on diskette complete with 8080 assembler, text editor, 8080 debugger and various utilities plus full documentation. CP/M available configured for most popular computer/disk systems including: North Star Single, Double or Quad density, Altair 8" disks, Helios II, Exidy Sorcerer, Vector MZ, Heath H17† or H89†, TRS-80†, iCOM 3712 and iCOM Micro Disk plus many other configurations available off the shelf.
.....$145/$25
CP/M version 2 (not all formats available immediately)
.....$170/$25

☐ **MP/M*** .....$300/$50

Lower prices!

☐ **MAC** — 8080 Macro Assembler. Full Intel macro definitions. Pseudo Ops include RPC, IRP, REPT, TITLE, PAGE, and MACLIB. Z80 library included. Produces Intel absolute hex output plus symbols file for use by SID (see below) .....$85/$15

☐ **SID** — 8080 symbolic debugger. Full trace, pass count and break-point program testing system with back-trace and histogram utilities. When used with MAC, provides full symbolic display of memory labels and equated values .....$70/$15

☐ **ZSID** — As above for Z80. Requires Z80 CPU $95/$25

☐ **TEX** — Text formatter to create paginated, page-numbered and justified copy from source text files, directable to disk or printer .....$70/$15

☐ **DESPOOL** — Program to permit simultaneous printing of data from disk while user executes another program from the console .....$45/$5

All Microsoft prices are discounted!

MICROSOFT

☐ **BASIC-80** — Disk Extended BASIC, ANSI compatible (L) (M) with long variable names, WHILE/WEND, chaining, variable length file records .....$300/$25

☐ **BASIC COMPILER** — Language compatible with (L) BASIC-80 and 3-10 times faster execution. Produces (M) standard Microsoft relocatable binary output. Includes Macro-80. Also linkable to FORTRAN-80 or COBOL-80 code modules .....$350/$25

☐ **FORTRAN-80** — ANSI '66 (except for COMPLEX) (L) plus many extensions. Includes relocatable object com- (M) piler, linking loader, library with manager. Also includes MACRO-80 (see below) .....$400/$25

☐ **COBOL-80** — Level 1 ANSI '74 standard COBOL plus (L) most of Level 2. Full sequential, relative, and indexed file (M) support with variable file names. STRING, UNSTRING, COMPUTE, VARYING/UNTIL, EXTEND, CALL, COPY, SEARCH, 3-dimensional arrays, compound and abbreviated conditions, nested IF. Powerful interactive screen-handling extensions. Includes compatible assembler, linking loader, and relocatable library manager as described under MACRO-80. .....$625/$25

☐ **MACRO-80** — 8080/Z80 Macro Assembler. Intel and (L) Zilog mnemonics supported. Relocatable linkable output. (M) Loader, Library Manager and Cross Reference List utilities included .....$149/$15

☐ **XMACRO-86** — 8086 cross assembler. All Macro and (L) utility features of MACRO-80 package. Mnemonics slightly modified from Intel ASM86. Compatibility data sheet available. .....$275/$25

☐ **EDIT-80** — Very fast random access text editor for text (L) with or without line numbers. Global and intra-line commands supported. File compare utility included $89/$15

MICRO FOCUS

☐ **STANDARD CIS COBOL** — ANSI '74 COBOL (L) standard compiler fully validated by U.S. Navy tests to ANSI level 1. Supports many features to level 2 including dynamic loading of COBOL modules and a full ISAM file facility. Also, program segmentation, interactive debug and powerful interactive extensions to support protected and unprotected CRT screen formatting from COBOL programs used with any dumb terminal .....$850/$50

☐ **FORMS 2** — CRT screen editor. Output is COBOL data (L) descriptions for copying into CIS COBOL programs. Automatically creates a query and update program of indexed files using CRT protected and unprotected screen formats. No programming experience needed. Output program directly compiled by CIS COBOL (standard) .....$200/$20

☐ **HDBS** — Hierarchical Data Base System. CODASYL oriented with FILEs, SETs, RECORDs and ITEMs which are all user defined. ADD/DELETE, UPDATE, SEARCH, and TRAVERSE commands supported. SET ordering is sorted, FIFO, LIFO, next or prior. One to many set relationship supported. Read/Write protection at the FILE level. Supports FILEs which extend over multiple floppy or hard disk devices.

☐ **MDBS** — Micro Data Base System. Full network data base with all features of HDBS plus multi-level Read/Write protection for FILE, SET, RECORD and ITEM. Explicit representation of one to one, one to many, many to many, and many to one SET relationships. Supports multiple owner and multiple record types within SETs. HDBS files are fully compatible.

☐ **MDBS-DRS** — MDBS with Dynamic Restructuring System option which allows altering MDBS data bases when new ITEMs, RECORDs, or SETs are needed without changing existing data.
HDBS-Z80 version .....$250/$35
MDBS-Z80 version .....$750/$35
MDBS-DRS-Z80 version .....$850/$35
8080 Version available at $75. extra.

Z80 version requires 20K RAM. 8080 version requires 24K RAM. (Memory requirements are additional to CP/M and application program.)
When ordering HDBS or MDBS please specify if the version required is for 1) Microsoft L80 i.e. FORTRAN-80, COBOL-80, BASIC COMPILER, 2) MBASIC 4. XX, or 3) BASIC-80 5.0.

Cover prices!

EIDOS SYSTEMS

Software with Manual / Manual Alone

☐ **KISS** — Keyed Index Sequential Search. Offers com- (L) plete Multi-Keyed Index Sequential and Direct Access file management. Includes built-in utility functions for 16 or 32 bit arithmetic, string/integer conversion and string compare. Delivered as a relocatable linkable module in Microsoft format for use with FORTRAN-80 or COBOL-80, etc. .....$335/$23

☐ **KBASIC** — Microsoft Disk Extended BASIC with all (L) KISS facilities, integrated by implementation of nine additional commands in language. Package includes KISS.REL as described above, and a sample mail list program .....$585/$45
To licensed users of Microsoft BASIC-80 (MBASIC) .....$435/$45

All Micropro prices are discounted!

MICROPRO

☐ **SUPER-SORT I** — Sort, merge, extract utility as absolute (L) executable program or linkable module in Microsoft (M) format. Sorts fixed or variable records with data in binary, BCD, Packed Decimal, EBCDIC, ASCII, floating, fixed point, exponential, field justified, etc. etc. Even variable number of fields per record! .....$225/$25

☐ **SUPER-SORT II** — Above available as absolute pro- (M)(L) gram only .....$175/$25

☐ **SUPER-SORT III** — As II without SELECT/EXCLUDE (M)(L) .....$125/$25

☐ **WORD-STAR** — Menu driven visual word processing (L) system for use with standard terminals. Text formatting (M) performed on screen. Facilities for text paginate, page number, justify, center and underscore. User can print one document while simultaneously editing a second. Edit facilities include global search and replace, read/write to other text files, block move, etc. Requires CRT terminal with addressable cursor positioning $445/$25

☐ **WORD-STAR/MAIL-MERGE** — As above with op- (L) tion for production mailing of personalized documents (M) with mail list from Data-Star or NAD. .....$575/$25

☐ **WORD-STAR Customization Notes** — For sophisticated users who do not have one of the many standard terminal or printer configurations in the distribution version of WORD-STAR. .....NA/$100

☐ **WORD-MASTER** Text Editor — In one mode has (L) superset of CP/M's ED commands including global (M) searching and replacing, forward and backwards in file. In video mode, provides full screen editor for users with serial addressable-cursor terminal .....$125/$25

☐ **DATASTAR** — Professional forms control entry and (L) display system for key-to-disk data capture. Menu driven (M) with built-in learning aids. Input field verification by length, mask, attribute (i.e. uppercase, lowercase, numeric, auto dup., etc.). Built-in arithmetic capabilities using keyed data, constants and derived values. Visual feedback for ease of forms design. Files compatible with all CP/M-MP/M supported languages. Requires 32K CP/M .....$350/$35

☐ **CBASIC-2** Disk Extended BASIC — Non-interactive (M) BASIC with pseudo-code compiler and runtime interpreter. Supports full file control, chaining, integer and extended precision variables, etc. .....$109/$15

☐ **PASCAL/M** — Compiler generates P code from ex- (I) tended language implementation of standard PASCAL. Supports overlay structure through additional procedure calls and the SEGMENT procedure type. Provides convenient string handling capability with the added variable type, STRING. Untyped files allow memory image I/O. Requires 56K CP/M .....$350/$30

☐ **PASCAL/Z** — Z80 native code PASCAL compiler. (I) Produces optimized, ROMable re-entrant code. All interfacing to CP/M is through the support library. The package includes compiler, companion macro-assembler and source for the library. Requires 56K and Z80 CPU.
Version 2 Includes all of Jensen/Wirth except variant records. .....$275/$25
Version 3 Upgrade with variant records and strings expected 2/80. .....$395/$25

☐ **PASCAL/MT —** Subset of standard PASCAL. Gen- (M) erates ROMable 8080 machine code. Symbolic debugger (X) included. Supports interrupt procedures and BCD arithmetic for real variables. CP/M file I/O and assembly language interface supported. Lacks Sets, Enumeration and Record data types. Manual explains BASIC to PASCAL conversion. Requires 32K .....$95/$30
Source for PASCAL/MT run time package. Requires MAC. (See under Digital Research.) $50

Structured Systems prices are discounted!

STRUCTURED SYSTEMS GROUP

☐ **GENERAL LEDGER** — Interactive and flexible system providing proof and report outputs. Customization of COA created interactively. Multiple branch accounting centers. Extensive checking performed at data entry for proof, COA correctness, etc. Journal entries may be batched prior to posting. Closing procedure automatically backs up input files. Now includes Statement of Changes in Financial Position. Requires CBASIC-2 .....$899/$25

☐ **ACCOUNTS RECEIVABLE** — Open item system with output for internal aged reports and customer-oriented statement and billing purposes. On-Line Enquiry permits information for Customer Service and Credit departments. Interface to General Ledger provided if both systems used. Requires CBASIC-2 .....$699/$25

☐ **ACCOUNTS PAYABLE** — Provides aged statements of accounts by vendor with check writing for selected invoices. Can be used alone or with General Ledger and/or with NAD. Requires CBASIC-2 $699/$25

Prices and specifications subject to change without notice.

Software with Manual / Manual Alone

☐ **INVENTORY CONTROL SYSTEM** — Performs control functions of adding and depleting stock items, adding new items and deleting old items. Tracks quantity of items on hand, on order and back-ordered. Optional hard copy audit trail is available. Reports include Master Item List, Stock Activity, Stock Valuation and Re-order List. Requires CBASIC-2 and 48K CP/M. . . $445/$25

☐ **ANALYST** — Customized data entry and reporting system. User specifies up to 75 data items per record. Interactive data entry, retrieval, and update facility makes information management easy. Sophisticated report generator provides customized reports using selected records with multiple level break-points for summarization. Requires CBASIC-2, 24 x 80 CRT, printer and 48K system. .....$225/$15

☐ **LETTERIGHT** — Program to create, edit and type letters or other documents. Has facilities to enter, display, delete and move text, with good video screen presentation. Designed to integrate with NAD for form letter mailings. Requires CBASIC-2 .....$179/$25

☐ **NAD** Name and Address selection system — interactive mail list creation and maintenance program with output as full reports with reference data or selected information for mail labels. Transfer system for extraction and transfer of selected records to create new files. Requires CBASIC-2 .....$79/$20

☐ **QSORT** — Fast sort/merge program for files with fixed record length, variable field length information. Up to five ascending or descending keys. Full back-up of input files created. .....$95/$20

Graham-Dorian prices are discounted!

GRAHAM-DORIAN SOFTWARE SYSTEMS

☐ **GENERAL LEDGER** — An on-line system; no batch- (L) ing is required. Entries to other GRAHAM-DORIAN ac- (M) counting packages are automatically posted. User establishes customized C.O.A. Provides transaction register, record of journal entries, trial balances and monthly closings. Keeps 14 month history and provides comparison of current year with previous year. Requires CBASIC-2. Supplied in source .....$495/$35

☐ **ACCOUNTS PAYABLE** — Maintains vendor list and (L) check register. Performs cash flow analysis. Flexible — (M) writes checks to specific vendor for certain invoices or can make partial payments. Automatically posts to GRAHAM-DORIAN general ledger or runs as stand alone system. Requires CBASIC-2. Supplied in source. .....$495/$35

☐ **ACCOUNTS RECEIVABLE** — Creates trial balance (L) reports, prepares statements, ages accounts and records (M) invoices. Provides complete information describing customer payment activity. Receipts can be posted to different ledger accounts. Entries automatically update GRAHAM-DORIAN general ledger or runs as stand alone system. Requires CBASIC-2. Supplied in source. .....$495/$35

☐ **PAYROLL SYSTEM** — Maintains employee master (L) file. Computes payroll withholding for FICA, Federal and (M) State taxes. Prints payroll register, checks, quarterly reports and W-2 forms. Can generate ad hoc reports and employee form letters with mail labels. Requires CBASIC-2. Supplied in source code. .....$495/$35

☐ **INVENTORY SYSTEM** — Captures stock levels, (L) costs, sources, sales, ages, turnover, markup, etc. (M) Transaction information may be entered for reporting by salesman, type of sale, date of sale, etc. Reports available both for accounting and decision making. Requires CBASIC-2. Supplied in source code. .....$495/$35

☐ **JOB COSTING** — Designed for general contractors. (L) To be used interactively with other GRAHAM-DORIAN (M) accounting packages for tracking and analysing expenses. User establishes customized cost categories and job phases. Permits comparison of actual versus estimated costs. Automatically updates GRAHAM-DORIAN general ledger or runs as stand alone system. Requires CBASIC-2. Supplied in source. .....$495/$35

☐ **APARTMENT MANAGEMENT SYSTEM** — Fi- (L) nancial management system for receipts and security (M) deposits of apartment projects. Captures data on vacancies, revenues, etc. for annual trend analysis. Daily report shows late rents, vacancy notices, vacancies, income lost through vacancies, etc. Requires CBASIC-2. Supplied in source code. .....$495/$35

☐ **CASH REGISTER** — Maintains files on daily sales. (L) Files data by sales person and item. Tracks sales, over- (M) rings, refunds, payouts and total net deposits. Requires CBASIC-2. Supplied in source code. .....$495/$35

☐ **tiny C** — Interactive interpretive system for teaching (X) structured programming techniques. Manual includes full source listings .....$75/$40

☐ **BDS C COMPILER** — Supports most major features (M) of language, including Structures, Arrays, Pointers, (I) recursive function evaluation, linkable with library to 8080 binary output. Lacks data initialization, long & float type and static & register class specifiers. Documentation includes "C" Programming Language book by Kernighan & Ritchie .....$110/$15

☐ **WHITESMITHS C COMPILER** — The ultimate in (L) systems software tools. Produces faster code than Pas- (X) cal with more extensive facilities. Conforms to the full UNIX*** Version 7 C language described by Kernighan and Ritchie, and makes available over 75 functions for performing I/O, string manipulation and storage allocation. Linkable to Microsoft REL files. Requires 60K CP/M .....$630/$30

☐ **POLYVUE/80** — Full screen editor for any CRT with (M) XY cursor positioning. Includes vertical and horizontal scrolling, interactive search and replace, automatic text wrap around for word-processing, operations for manipulating blocks of text, and comprehensive 70 page manual. .....$135/$15

☐ **POLYTEXT/80** — Text formatter for word processing (M) applications. Justifies and paginates source text files. Will generate form letters with system fields and conditional processing. Support for Daisy Wheel printers includes variable pitch justification and motion optimization. .....$85/$15

☐ **ALGOL-60** — Powerful block-structured language compiler featuring economical run time dynamic allocation of memory. Very compact (24K total RAM) system implementing almost all Algol 60 report features plus many powerful extensions including string handling direct disk address I/O etc. Requires Z80 CPU .....$199/$20

*CP/M is a trademark of Digital Research.
**Z80 is a trademark of Zilog, Inc.
***UNIX is a trademark of Bell Laboratories.
****WHATSIT? is a trademark of Computer Headware.
*****Electric Pencil is a trademark of Michael Shrayer Software.
★TRS-80 is a trademark of Tandy Corp.

†CP/M for Heath, TRS-80 Model I and PolyMorphic 8813 are modified and must use specially compiled versions of system and applications software.
(M) Modified version available for use with CP/M as implemented on Heath and TRS-80 Model I computers.

(L) User license agreement for this product must be signed and returned to Lifeboat Associates before shipment may be made.

(I) This product Includes/Excludes the language
(X) manual recommended in Sundries and Notions above.

Software with Manual / Manual Alone

☐ **Z80 DEVELOPMENT PACKAGE** — Consists of: (M) (1) disk file line editor, with global inter and intra-line facilities; (2) Z80 relocating assembler, Zilog/Mostek mnemonics, conditional assembly and cross reference table capabilities; (3) linking loader producing absolute Intel hex disk file. .....$95/$20

☐ **ZDT-** Z80 Monitor Debugger to break and examine (M) registers with standard Zilog/Mostek mnemonic disassembly displays $35 when ordered with Z80 Development Package .....$50/$10

☐ **DISTEL** — Disk based disassembler to Intel 8080 or TDL/Xitan Z80 source code, listing and cross reference files. Intel or TDL/Xitan pseudo ops optional. Runs on 8080. .....$65/$10

☐ **DISILOG** — As DISTEL to Zilog Mostek mnemonic (M) files. Runs on Z80 only .....$65/$10

NEW!

☐ **XASM-68** — Non-macro cross-assembler with nested conditionals and full range of pseudo operations. Assembles from standard Motorola MC6800 mnemonics to Intel hex. .....$200/$25

NEW!

☐ **XASM-65** — As XASM-68 for MOS Technology MCS6500 mnemonics. .....$200/$25

☐ **TEXTWRITER III** — Text formatter to justify and pagi- (M) nate letters and other documents. Special features include insertion of text during execution from other disk files or console, permitting recipe documents to be created from linked fragments on other files. Has facilities for sorted index, table of contents and footnote insertions. Ideal for contracts, manuals, etc. Now compatible with Electric Pencil***** prepared files. .....$125/$20

☐ **POSTMASTER** — A comprehensive package for mail (M) list maintenance. Features include keyed record extraction and label production. A form letter program is included which provides neat letters on single sheet or continuous forms. Requires CBASIC-2 .....$150/$15

☐ **WHATSIT?******* Interactive data-base system using associative tags to retrieve information by subject. Hashing and random access used for fast response. Requires CBASIC-2 .....$125/$25

☐ **XYBASIC** Interactive Process Control BASIC — Full disk BASIC features plus unique commands to handle bytes, rotate and shift, and to test and set bits. Available in Integer, Extended and ROMable versions.
Integer Disk or Integer ROMable .....$295/$25
Extended Disk or Extended ROMable .....$395/$25

☐ **SMAL/80** Structured Macro Assembled Language — Package of powerful general purpose text macro processor and SMAL structured language compiler. SMAL is an assembler language with IF-THEN-ELSE, LOOP-REPEAT-WHILE, DO-END, BEGIN-END constructs .....$75/$15

☐ **SELECTOR III-C2** — Data Base Processor to create (M) and maintain multi Key data bases. Prints formatted, sorted reports with numerical summaries or mailing labels. Comes with sample applications, including Sales Activity, Inventory, Payables, Receivables, Check Register, and Client/Patient Appointments, etc. Requires CBASIC-2 Version 2. Supplied in source code $295/$20

☐ **CPM/374X** — Has full range of functions to create or re-name an IBM 3741 volume, display directory information and edit the data set contents. Provides full file transfer facilities between 3741 volume data sets and CP/M files .....$195/$10

☐ **BASIC UTILITY DISK** — Consists of: (1) CRUNCH- (M) 14 – Compacting utility to reduce the size and increase the speed of programs in Microsoft Basic and TRS-80 Basic. (2) DPFUN – Double precision subroutines for computing nineteen transcendental functions including square root, natural log, log base 10, sin, arc sin, hyperbolic sin, hyperbolic arc sin, etc. Furnished in source on diskette and documentation .....$50/$35

☐ **THE STRING BIT** — Fortran character string han- (M) dling. Routines to find, fill, pack, move, separate, concatenate and compare character strings. This package completely eliminates the problems associated with character string handling in FORTRAN. Supplied with source .....$45/$15

☐ **BSTAM** — Utility to link one computer to another also (M) equipped with BSTAM. Allows file transfers at full data speed (no conversion to hex) with CRC block control check for very reliable error detection and automatic retry. We use it! It's great. Full wildcard expansions to send ★.COM, etc. 9600 baud with wire, 300 baud with phone connection. Both point-to-point Standard and M versions can talk to one another. Compatible TRSDOS version also available .....$150/$5

★ ★ ★ ★ ★ ★

SUNDRIES &NOTIONS

☐ **HEAD CLEANING DISKETTE** — Cleans the drive read/write head in 30 seconds. Diskette absorbs loose oxide particles, finger prints and other foreign particles that might hinder the performance of the drive head. Lasts at least 3 months with daily use. Specify 5" or 8" .....$20. ea./$45. for 3

☐ **Flippy Disk Kit** — Template and instructions to modify single sided 5¼" diskettes for use of second side in single sided drives $12.50

☐ **FLOPPY SAVER** Protection for center holes of 5¼" floppy disks. Only 1 needed per diskette. Kit contains centering post, pressure tool, tough 7-mil mylar reinforcing rings. Installation tools and rings for 25 diskettes. $14.95
Re-orders of rings only $7.95

☐ **PASCAL USER MANUAL AND REPORT** — By Jensen and Wirth. The standard textbook on the language. Recommended for use by Pascal/Z, Pascal/M and Pascal/MT users. $8

☐ **THE C PROGRAMMING LANGUAGE** — By Kernighan and Ritchie. The standard textbook on the language. Recommended for use by BDS C, tiny C, and Whitesmiths C users. $12

★ ★ ★ ★ ★ ★

Shopping List No.9

Everything on Shopping List #9 runs on 64K TRS-80 Model II

Software for most popular 8080/Z80 computer disk systems including ***NORTH STAR, iCOM, MICROPOLIS, DYNABYTE DB8/2 & DB8/4, EXIDY SORCERER, SD SYSTEMS, ALTAIR, VECTOR MZ, MECCA, 8" IBM, HEATH H17 & H89, HELIOS, IMSAI VDP42 & 44, REX, NYLAC, INTERTEC, VISTA V80*** *and* ***V200, TRS-80 MODEL I*** *and* ***MODEL II, ALTOS, OHIO SCIENTIFIC*** *and* ***IMS 5000*** *formats.*

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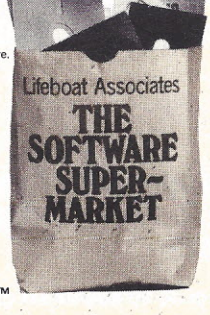

™

Orders must specify disk systems and formats: e.g. North Star single, double or quad density, IBM single or 2D/256, Altair, Helios II, Micropolis Mod I or II, 5¼" soft sector (Micro iCOM/SD Systems Dynabyte), etc.

Prices F.O.B. New York. Shipping, handling and C.O.D. charges extra.

Manual cost applicable against price of subsequent software purchase.

The sale of each proprietary software package conveys a license for use on one system only.

Lifeboat Associates, 2248 Broadway, N.Y., N.Y. 10024
(212) 580-0082 Telex: 220501 (New number!)

Heuristics

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2000

Talk To Your Computer . . .

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- User variable vocabulary (64 words and up)
- Applesoft & Integer Basic compatible with or without disk operating system

Useful For . . .

- Collecting inventory data
- Running the Apple® as a terminal
- Controlling production test equipment (say "test 2")
- Menu selection of programs (say "stocks")
- Entering stock market data
- Educational programs for the kids (say "square")

See your computer dealer.
Model 2000 suggested retail price $259, model 20A $189.

Heuristics INC

1285 HAMMERWOOD AVENUE
SUNNYVALE, CALIFORNIA 94086
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3. How much memory do the programs require to operate efficiently
4. Are input, output, and especially processing times fast enough (test the system with a large amount of test data).
5. What are the limits on the size of numbers and what precision do they have (I worked on one system that, believe it or not, included rounding errors in some numbers, meaning the darn thing could not actually add a column of figures correctly.)

Another consideration in software evaluation is *expandability.* If your initial foray into data processing with an accounts receivable experiment is successful, you'll soon be moving on to payables, general ledger, mailing lists, and a host of other applications. If you like the programs you're working with well enough to go on to other applications, you'll want to use the same source for your software. The biggest advantage of getting all your software from one vendor is that a well written set of business programs will automatically send information from one system to another. The order entry system may automatically relieve your inventory file. Accounts payable may overlay to the general ledger. Find out how much the various files interact with each other.

HOW TO SHOP

In my opinion, there is only one way to shop for an accounts receivable system, and it is definitely not by mail. It's a fairly time consuming and painstaking procedure, but given the large amount of inadequate business software on the market today, the critical nature of the task required by an accounts receivable system, and your probable inexperience in buying software, we come to my one inviolable rule of software selection: TRY IT BEFORE YOU BUY IT.

This does not mean listening patiently to the salesperson's demo routine. Bring into the computer store a substantial amount of your own test data, live data, on the source documents that you'll be using yourself. Be prepared to spend four to six hours a week at this task. Starting from scratch, build your customer master file. Input about half the invoices. Run through the complete cycle, generating all the reports on the system. Do the backup procedure. Enter the second half of the data, this time taking care to do everything wrong you can possibly think of. Deliberately try to break the system. Give it bad data. Hit the wrong keys. Note how the programs respond to these situations. If properly written, the programs will not blow up. They should correct the errors you are making.

While you are working on the system take note of such things as the ease of input procedures, the amount of time you have to wait for the computer to do its work (your wait time), and take copious notes. Go through this exercise on at least three different software packages, always using the hardware that you own or will own. If, for some reason, you cannot arrange to go through this exercise for a given package that you're interested in, don't buy it.

Any vendors worth doing business with will welcome your rigorous test of their software. If they fail, they'll be able to upgrade their programs to do the job correctly. If they pass your test, you'll become a solid gold recommendation for their product. Incidentally, the best place to do this sort of evaluation is at one of their existing customer's sites, without the presence of the vendor. That way you get to see the machine and programs in a live environment and get the benefit of honest feedback from a live user who has no vested interest in selling you anything.

Following this procedure should result in the selection of the best possible package for your needs and a successful experience in automating your business.□

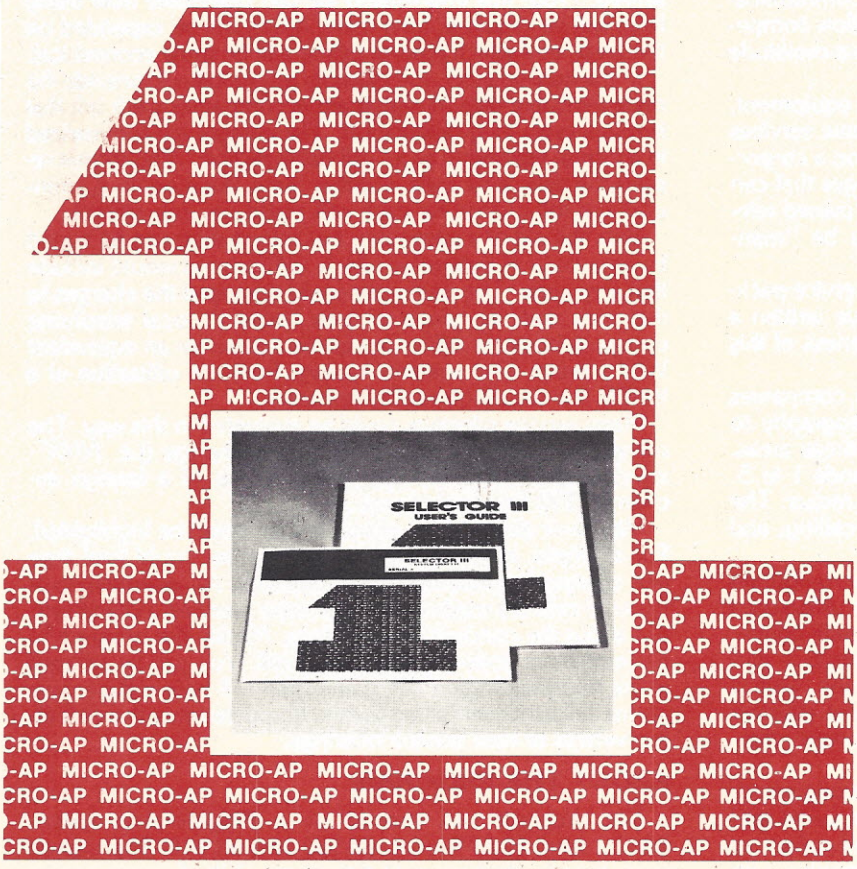
CIRCLE INQUIRY NO. 45

SELECTOR III - C2

THE INFORMATION MANAGEMENT SYSTEM

Includes these Application Sub-Programs. . .

Sales Activity, Inventory, Payables, Receivables, Check/Expense Register, Library Functions, Mailing Labels, Appointments, Client/Patient Records



NEW RELEASE

GLector — General Ledger Option

The industry's most powerful, flexible and informative GL system is now available from Micro-Ap. Look at these features. . .

- Transaction entries by type.
- Trial Balance upon entry.
- No need to memorize account numbers or whether credited or debited.
- Full 24 month data storage.
- Update any account balance in current fiscal year with automatic month re-computation.
- Balance sheet as of any month with current and last year balances.
- P & L for any period of current fiscal year. . .any time. . .contains current and last year periods, % of sales, YTD, and % change for period.
- Automatic year-end closing.
- Menu selected. . .instant ISAM retrievals.
- Introductory price. . .$250.
- Requires SELECTOR III-C2.
- Requires 52K memory

RANDOM, MULTI-KEY RECORD RETRIEVAL under CP/M, CDOS, IMDOS, ADOS . . .

SELECTOR III-C2 ALLOWS INSTANT RECALL OF ANY RECORD USING ANY INFORMATION ITEM IN THE RECORD. That statement deserves re-reading, because that ability makes **SELECTOR III-C2** the most powerful information management system in microcomputers today!

The three major activities in business computing are...Word Processing, Financial Accounting, and the storing, processing, and reporting of information. The latter is where **SELECTOR III-C2** shines and fills the professional and personal need.

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CIRCLE INQUIRY NO. 62

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The system runs under CBASIC Vers. 2, and is priced at $345. It's available in a variety of CP/M, disk formats including Dynabyte; North Star; Micropolis; TRS-80; Helios II; Heathkit; iCOM; Altair; Imsai; Cromemco; and others.

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A Telephone Management System

By Peter S. Buswell

Until the last part of the 1960s, there were no alternatives to the service or equipment provided by the local telephone company. Today, ten years after the Federal Communications Commission (FCC) enacted legislation to allow competition in the telecommunications industry, there is a multitude of equipment and vendors to choose from.

In addition to the availability of sophisticated equipment, competition has contributed to the creation of new services dedicated to lowering the long distance charges on a corporate phone bill. Unlike the equipment rental charges that can be eliminated through the purpose of customer owned telephone systems, long distance charges have to be "managed."

To help clarify this concept, I have selected a service package many companies are familiar with and have written a program to assist in evaluating the cost effectiveness of this offering.

Wide Area Telephone Service (WATS) allows companies with calling patterns to or from a particular geography to realize a discount on long distance charges to these areas. The continental United States is divided into Bands 1 to 5, comprising surrounding states in an increasing radius. The home state is removed to Band 0 for intrastate calling, and International calls are removed to Band 7.

The service is available either as inbound or outbound WATS and is billed monthly in one of two ways: *Measured Service*, a flat rate for the first ten hours of usage with continuing charges thereafter billed at a 1/10 hour unit basis; or *Full Business Day*, unlimited calling for 240 hours with a minimal overtime charge. To determine how cost effective WATS will be for a company, several important characteristics of calling patterns must be analyzed.

First, determine how long distance charges are originated. Do customers call collect? Do field service personnel and sales representatives call in regularly? Do they call collect, or use credit cards and expense accounts? Companies with these types of calls might be candidates for an incoming WATS line (the infamous "toll free 800 number"), though toll charges are inflated by the operator assistance charges.

On request, the phone company will provide a colored WATS map, showing the breakdown of each Band. Are your long distance charges particular to any geography (i.e. area code)? Companies which are national may realize considerable savings by using different Band lines to overcome long distance charges on local lines. Regional companies, as well as local companies, can benefit from the use of WATS service if they have heavy calling in a particular area.

Consideration of these matters supplies enough information to specify an "Incoming Band 1" or an "Outgoing Band 5." To determine how many lines to install and whether to use Measured or Full Business Day billing depends on the expected "average call holding time."

Would a company need as many outgoing lines to support 100 calls of 60 seconds in duration as it would if the 100 calls were 90 seconds in duration? What if these calls were logged in the hour between 10 and 11 a.m. as opposed to a 20-hour period? The "average call holding time" is a characteristic used to determine the traffic and requirements. Usually a peak calling period is observed. This would be the point during the day in which the most telephone calls are handled. The number of calls completed, both in and out, are counted and the duration of each call is logged.

Multiplying the average call holding time (i.e. duration) by the number of calls completed, we can determine how many seconds a single line would be occupied for the period observed. From this information we can determine how many lines will be required, how many hours will be expended on the lines, and which type of billing will be most economical.

In the final analysis, the monthly phone bill will provide the most verifiable data. A statement accompanies each bill that itemizes every long distance call. The charges are summarized in a format referred to as a "call detail record." This format reports the date, area code, number, time, duration (in 1/10 minute) and toll charge for each call made on your system.

With the aid of a computer, this information can be sorted by area code to determine which WATS band would include that area code. The computer could then total the charges to that area code or group of area codes. A local telephone company business office can quote a price for an equivalent WATS Band. The potential savings from the utilization of a WATS line would be readily apparent.

Many service offerings could be evaluated in this way. The computer could sort by a particular exchange (i.e. *NNX - xxxx*) to determine the cost effectiveness of a foreign exchange (FX) line to that area.

Misuse or abuse of the phone system could be highlighted. For example, a sort by a particular *number* could total time and charges for unauthorized phone calls. An examination of the *time* calls are made can reveal some interesting characteristics about the conduct of a business. Modify the program to perform other sorts on *your* phone bill. You will be amazed at the information you can gather that will help reduce your phone bill, uncover billing errors, and determine the cost effectiveness of new service offerings.

ABOUT THE PROGRAM

The program was created on a PolyMorphic system 8813, using PolyMorphic BASIC version 8.1. The system is equipped with three mini-disk drives, 32k of user program memory, a Poly VTM keyboard, and a 132-column Teletype Model 43. A working knowledge of BASIC and disk I/O is all that is required to convert this program to different versions of BASIC.

On initialization, the program declares all arrays used to hold data and name files. The system then displays a "menu," and you are asked to select a function. The functions are nothing more than convenient stopping points in program execution, so they must be selected in order until the program has run at least one time in its entirety. Print CHR$(12) causes a clear screen in Poly BASIC, while PLOT X, Y, Z positions the cursor for screen cosmetics.

Function Number 1 — "Enter Call Detail Records" — anticipates key to disk entry of the call detail records as they appear on the phone bill. First a call detail record file is created with the name contained in C$ entered on line 115. This file will serve as the dispository for the CDR input in lines 135-165. Lines 170 through 215 give you an opportunity to reenter incorrect records. Line 220 tests to verify that the file has been open before printing the CDR to the file and returning (line 235) for the next CDR. When R (line 120, 125) is reached or a 0 is entered for date, the file is closed and the menu is returned to the screen.

Function Number 2 — "Sort by WATS Band" — is a two pass routine. The first pass creates a file for each Band (0-7) 50 records long. Each file is opened in turn, and each of the records padded with the data contained in line 285. The sec-

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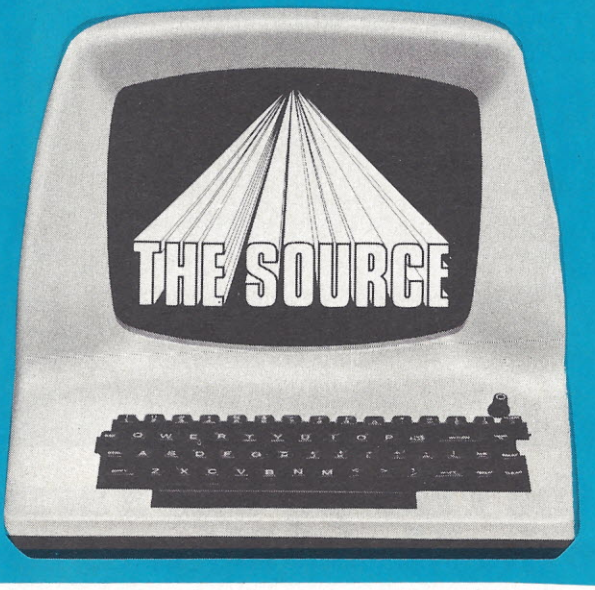

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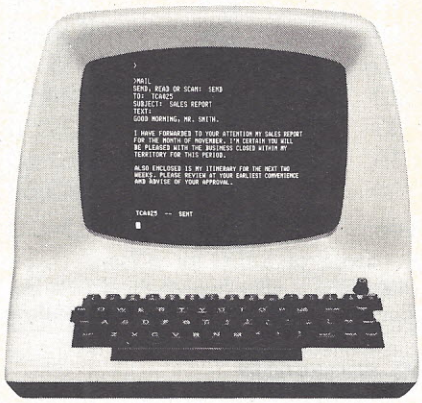

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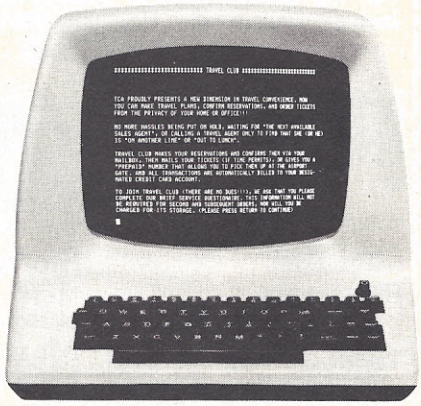

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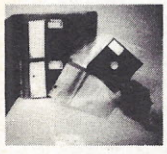

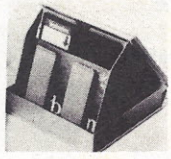

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CIRCLE INQUIRY NO. 31

ond pass sorts the records contained in the input file, C1, to one of the Band files by area code. Call records with the area code specified in line 330 will be put in the Band 0 file. Calls that cannot be matched to area codes contained in Bands 1-6, will be considered as international calls and put in the Band 7 file. The sort is obtained by reading in the first call record from the data file (C$) determining the area code, then searching the data statements (lines 750-915) until a match is found. The pointer contained in R (line 410) determines which output file (Band) to deposit the call records.

Function Number 3 — "Print Files" — will cause the contents of each Band to be printed. The statistical data will be totaled. These statistics can be analyzed to determine the cost effectiveness of a given WATS installation.

The summary report and itemized listing by Band was generated by the TMS program. The customer specified area code 203 as "Home," so all Connecticut calls are listed under Band 0.

Summary of Call Activity

WATS	# Calls	Duration	Total Cost
BAND1	19	284	$41.40
BAND2	14	82	$30.00
BAND3	5	19	$7.70
BAND4	20	988	$234.80
BAND5	33	104	$37.30
IDDD	10	464	$861.50
BAND0	50	2767	$643.00
TOTAL	906	28248	$11,134.20

Assuming a nominal charge of $250 for a Band 0, outbound full business day WATS, this hypothetical customer might save some dollars. **Program follows**

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PROGRAM LISTING 1

```
10 REM ******************************************************
15 REM      TELEPHONE MANAGEMENT SYSTEM FOR MICROCOMPUTER
20 REM
25 REM          WRITTEN BY PETER S. BUSWELL
30 REM ******************************************************
35 FILE:3,LIST
40 DIM D(10),A(10),N(10),T(10),L(10),A1(10),M1(7),L1(7),R(7)
45 DIM B$(7:5),F$(1:12),C$(1:12)
50 B$(1)="BAND1"\B$(2)="BAND2"\B$(3)="BAND3"\B$(4)="BAND4"
55 B$(5)="BAND5"\B$(6)="IDDD"\B$(7)="BANDO"
60 PRINT CHR$(12)\PRINT\PRINT "  TELEPHONE MANAGEMENT SYSTEM"
65 PRINT
70 PRINT TAB(12),"FUNCTION NO.1 : ENTER CALL DETAIL RECORDS"
75 PRINT TAB(12),"FUNCTION NO.2 : SORT BY WATTS BAND"
80 PRINT TAB(12),"FUNCTION NO.3 : PRINT FILES"
85 PRINT
90 PRINT TAB(12),\INPUT "ENTER DESIRED FUNCTION NO.",Q
95 PRINT TAB(12),\INPUT "ENTER '1' FOR SCREEN : '3' FOR HARD COPY",U
100 ON Q GOTO 105,260,535
105 REM CREATE DATA (CDR) FILE
110 PRINT CHR$(12)
115 INPUT "ENTER ACCOUNT (FILE) NAME ",C$
120 INPUT "APPROXIMATE # OF RECORDS YOU WILL ENTER",R
125 FOR X=1TOR
130 PRINT CHR$(12)\PLOT 0,30,1\PRINT "SET DATE = '0' TO EXIT"
135 PRINTTAB(30),\INPUT "DATE       ",D(X)
140 IF D(X)=0 THEN EXIT 240
145 PRINTTAB(30),\INPUT "AREA CODE  ",A(X)
150 PRINTTAB(30),\INPUT "NUMBER     ",N(X)
155 PRINTTAB(30),\INPUT "TIME       ",T(X)
160 PRINTTAB(30),\INPUT "LENGTH     ",L(X)
165 PRINTTAB(30),\INPUT "AMOUNT     ",A1(X)
170 REM VERIFY BEFORE BUFFER STOREAGE
175 PRINT CHR$(12)\PLOT 0,30,1
180 PRINTTAB(30),"DATE      ",D(X)
185 PRINTTAB(30),"AREA CODE ",A(X)
190 PRINTTAB(30),"NUMBER    ",N(X)
195 PRINTTAB(30),"TIME      ",T(X)
200 PRINTTAB(30),"LENGTH    ",L(X)
205 PRINTTAB(30),"AMOUNT    ",A1(X)
210 PRINT\PRINTTAB(30),\INPUT "RE-ENTER ?",Q$
215 IF LEFT$(Q$,1)="Y" THEN GOTO 130
220 IF X>1 THEN GOTO 230
225 FILE:4,OPEN,C$,OUT
230 PRINT:4,%6I,D(X),A(X),%10I,N(X),%6I,T(X),L(X),%7F1,A1(X)
235 NEXT
240 D=0\A=0\N=0\T=0\L=0\A1=0\REM PAD FOR EOF
245 PRINT:4,%6I,D,A,%10I,N,%6I,T,L,%7F1,A1
250 FILE:4,CLOSE
255 GOTO 60
260 REM CREATE DATA FILES
265 FOR X=1TO7
270 F$="<3>"+B$(X)
275 FILE:6,OPEN,F$,OUT
280 FOR C=1TO50
285 D=0\A=0\N=0\T=0\L=0\A1=0\REM PAD FILE WITH 0
290 REM DATE=D ACODE=A NUMBER=N TIME=T LENGTH=L
295 REM AMOUNT=A1 TOTAL LENGTH=L1 TOTAL AMOUNT=M1
300 PRINT:6,%6I,D,A,%10I,N,%6I,T,L,%7F1,A1
305 NEXT C\REM NEXT CDR
310 FILE:6,CLOSE
315 NEXT X\REM NEXT FILE
320 PRINT CHR$(12)\PRINT\PRINT "FILES COMPLETE"
325 INPUT "HIT RETURN TO COUNTINUE",Q$
330 INPUT "HOME AREA CODE ",H\REM DETERMINE BANDO CALLS
335 INPUT "ENTER ACCOUNT (CDR) DATA  FILE NAME",C$
340 FILE:4,OPEN,C$,INPUT\C=0
345 FOR X=1TO10\REM CREATE 10 RECORD BUFFER
350 C=C+1
355 INPUT:4,D(X),A(X),N(X),T(X),L(X),A1(X)
360 IF D(X)=0 THEN Y=X-1\EXIT 390
365 NEXT
370 REM DETERMINE PROPER FILE BY AERA CODE
375 PRINT:U,"FILING - STANDBY. ",C," RECORDS READ FROM INPUT FILE."
380 Y=10
385 REM Y=MAX. (<10) CDR THIS BUFFER. REMEMBER EXIT ROUTINE
390 FOR X=1TOY
395 IF A(X)=H THEN B=7\GOTO 470
400 REM SEARCH DATA STATEMENTS FOR MATCHING AREA CODE
405 RESTORE
410 R=1\REM R=COUNTER FOR AERA CODE MATCH
415 READ Z
420 IF Z=A(X) THEN GOTO 440\REM MATCH GO FILE
425 R=R+1
430 IF R>150 THEN B=6\GOTO 470\REM MUST BE IDDD!
435 GOTO 415
440 REM OUTPUT 1ST RECORD FROM BUFFER TO FILE BY BAND #
445 IF (R=>1) AND (R<=30) THEN B=1\GOTO 470
450 IF (R>30) AND (R<60) THEN B=2\GOTO 470
455 IF (R>60) AND (R<=90) THEN B=3\GOTO 470
460 IF (R>90) AND (R<=120) THEN B=4\GOTO 470
465 IF (R>120) AND (R<=150) THEN B=5\GOTO 470
470 F$="<3>"+B$(B)
475 FILE:6,OPEN,F$,INOUT\E=0
```

```
480 E=E+1
485 INPUT:6,D,A,N,T,L,A1
490 IF A>0 THEN GOTO 480
495 FILE:6,POS,E
500 PRINT:6,%6I,D(X),A(X),%10I,N(X),%6I,T(X),L(X),%7F1,A1(X)
505 FILE:6,CLOSE
510 NEXT\REM GET NEXT CDR FROM BUFFER
515 PRINT:U,"READING 10 CDR'S TO BUFFER"
520 GOTO 345\REM GET 10 MORE CDR'S INTO BUFFER
525 FILE:4,CLOSE
530 GOTO 60\REM FINISHED! RETURN TO MENUE
535 REM PRINT ROUTINE
540 FILE:3,LIST
545 PRINT:U,"TELEPHONE COST ANALYSIS BY WATTS FOR ACCOUNT: ",C$
550 PRINT:U,CHR$(13)\PRINT:U,CHR$(13)
555 FOR X=1TO7
560 M1(X)=0\L1(X)=0\R(X)=0\C=1\R2=0\L2=0\M2=0
565 F$="<3>"+B$(X)
570 FILE:4,OPEN,F$,INPUT
575 PRINT:U,"  DATE",TAB(12),"AREA",TAB(22),"NUMBER",TAB(34),
580 PRINT:U,"TIME",TAB(43),"LEN.",TAB(52),"COST",TAB(61),F$
585 PRINT:U,"------",TAB(11),"------",TAB(20),"----------",
590 PRINT:U,TAB(33),"------",TAB(42),"------",TAB(51),"-------"
595 INPUT:4,D,A,N,T,L,A1
600 IF A=0 THEN GOTO 625
605 PRINT:U,TAB(2),D,TAB(11),A,TAB(20),N,TAB(33),
610 PRINT:U,T,TAB(42),%4F1,L,TAB(51),%C5F2,A1
615 L1(X)=L1(X)+L\M1(X)=M1(X)+A1\R(X)=R(X)+1
620 C=C+1\GOTO 595
625 FILE:4,CLOSE
630 PRINT:U,CHR$(12)
635 NEXT
640 PRINT:U,CHR$(12)
645 PRINT:U,"SUMMARY OF CALL ACTIVITY"
650 PRINT:U,"-------------------------"
655 PRINT:U,CHR$(13)
660 PRINT:U,TAB(7),"WATTS",TAB(16),"# CALLS",TAB(26),
665 PRINT:U,"DURATION",TAB(37),"TOTAL COST"
670 PRINT:U,TAB(7),"-----",TAB(16),"-------",TAB(26),
675 PRINT:U,"--------",TAB(37),"----------"
680 FOR X=1TO7
685 PRINT:U,TAB(7),B$(X),TAB(18),R(X),TAB(28),%5F1,L1(X),
690 PRINT:U,TAB(40),%C$8F2,M1(X)
695 R2=R2+R(X)\L2=L2+L1(X)\M2=M2+M1(X)
700 NEXT\PRINT:U,CHR$(13)
705 PRINT:U,TAB(7),"TOTAL",TAB(18),R2,TAB(28),%5F1,L2,
710 PRINT:U,TAB(40),%C$10F2,M2
715 GOTO 60
720 REM FILE ERROR ROUTINE FOR INPUT FILE
725 PRINT:U,C," BAD RECORD IN CDR DATA FILE"
730 FILE:4,POS,C+1\RETURN
```

```
 FILING - STANDBY.  3 RECORDS READ FROM INPUT FILE.
 READING 10 CDR'S TO BUFFER
 FILING - STANDBY.  4 RECORDS READ FROM INPUT FILE.
 READING 10 CDR'S TO BUFFER
 FILING - STANDBY.  5 RECORDS READ FROM INPUT FILE.
 READING 10 CDR'S TO BUFFER
 FILING - STANDBY.  6 RECORDS READ FROM INPUT FILE.
 READING 10 CDR'S TO BUFFER
 FILING - STANDBY.  7 RECORDS READ FROM INPUT FILE.
 READING 10 CDR'S TO BUFFER
 FILING - STANDBY.  8 RECORDS READ FROM INPUT FILE.
 READING 10 CDR'S TO BUFFER
 FILING - STANDBY.  9 RECORDS READ FROM INPUT FILE.
 READING 10 CDR'S TO BUFFER
 FILING - STANDBY.  10 RECORDS READ FROM INPUT FILE.
 READING 10 CDR'S TO BUFFER
```

SAMPLE RUN 2

```
 TELEPHONE MANAGEMENT SYSTEM

          FUNCTION NO.1 : ENTER CALL DETAIL RECORDS
          FUNCTION NO.2 : SORT BY WATTS BAND
          FUNCTION NO.3 : PRINT FILES

          ENTER DESIRED FUNCTION NO.1
          ENTER '1' FOR SCREEN : '3' FOR HARD COPY1
ENTER ACCOUNT (FILE) NAME TEST DATA
APPROXIMATE # OF RECORDS YOU WILL ENTER190


SET DATE = '0' TO EXIT
                                DATE        905
                                AREA CODE   215
                                NUMBER      5621566
                                TIME        426
                                LENGTH      3
                                AMOUNT      1.00
                                DATE        905
                                AREA CODE   215
                                NUMBER      5621566
                                TIME        426
                                LENGTH      3
                                AMOUNT      1

                                RE-ENTER ?NO


SET DATE = '0' TO EXIT
                                DATE        831
                                AREA CODE   305
                                NUMBER      6243131
```

```
735 REM FILE ERROR ROUTINE FOR OUTPUT FILE
740 PRINT:U,E," BAD RECORD IN SORTED FILE"
745 FILE:6,POS,E+1\RETURN
750 REM BAND 1
755 DATA 603,413,617,401,203
760 DATA 516,212,201,609,914
765 DATA 518,315,607,000,000
770 DATA 000,000,000,000,000
775 DATA 000,000,000,000,000
780 DATA 000,000,000,000,000
785 REM BAND 2
790 DATA 207,802,716,814,717
795 DATA 412,215,301,703,000
800 DATA 804,302,202,000,000
805 DATA 000,000,000,000,000
810 DATA 000,000,000,000,000
815 DATA 000,000,000,000,000
820 REM BAND 3
825 DATA 218,612,715,507,608
830 DATA 414,712,515,319,000
835 DATA 308,402,913,816,316
840 DATA 417,314,501,318,601
845 DATA 504,205,904,813,305

850 DATA 000,000,000,000,000
855 REM BAND 4
860 DATA 906,616,517,313,312
865 DATA 815,309,219,419,216
870 DATA 217,317,513,614,618
875 DATA 812,502,606,304,901
880 DATA 615,704,919,404,803
885 DATA 912,000,000,000,000
890 REM BAND 5
895 DATA 206,509,406,701,503
900 DATA 208,307,605,916,707
905 DATA 702,801,303,415,408
910 DATA 209,805,213,714,602
915 DATA 505,806,405,918,817
920 DATA 000,000,000,000,000
```

SAMPLE RUN 1

```
FILES COMPLETE
HIT RETURN TO CONTINUE
HOME AREA CODE 203
ENTER ACCOUNT (CDR) DATA FILE NAME TEST DATA


FILING - STANDBY.  1 RECORDS READ FROM INPUT FILE.
READING 10 CDR'S TO BUFFER
FILING - STANDBY.  2 RECORDS READ FROM INPUT FILE.
READING 10 CDR'S TO BUFFER
```

```
TIME        1026
LENGTH      5
AMOUNT      2.00
DATE        831
AREA CODE   305
NUMBER      6243131
TIME        1026
```

SAMPLE RUN 3

```
TELEPHONE MANAGEMENT SYSTEM

        FUNCTION NO.1 : ENTER CALL DETAIL RECORDS
        FUNCTION NO.2 : SORT BY WATTS BAND
        FUNCTION NO.3 : PRINT FILES

        ENTER DESIRED FUNCTION NO.3
        ENTER '1' FOR SCREEN : '3' FOR HARD COPY1

TELEPHONE COST ANALYSIS BY WATTS FOR ACCOUNT:
```

DATE	AREA	NUMBER	TIME	LEN.	COST	<3>BAND1
84	607	3267193	1146	45.0	5.30	
814	914	7635280	1141	34.0	3.50	
828	212	5589609	446	9.0	2.80	
828	212	6898669	1218	3.0	1.00	
829	212	7528000	1049	2.0	.70	
212	212	7526000	349	16.0	4.80	
831	212	5357400	323	3.0	1.00	
905	401	8329000	1147	1.0	.40	
907	201	2276400	524	4.0	.80	
911	212	7528900	1145	2.0	.70	
907	617	9886090	311	2.0	.70	
918	315	4625961	135	1.0	.50	
926	212	7886000	150	1.0	.40	
926	212	7886000	150	1.0	.40	
84	607	3267193	1146	45.0	5.30	
814	914	7635280	1141	34.0	3.50	
828	212	5589609	446	9.0	2.80	
828	212	6898669	1218	3.0	1.00	
829	212	7528000	1049	2.0	.70	
212	212	7526000	349	16.0	4.80	
831	212	5357400	323	3.0	1.00	
905	401	8329000	1147	1.0	.40	
907	201	2276400	524	4.0	.80	
911	212	7528900	1145	2.0	.70	
907	617	9886090	311	2.0	.70	
918	315	4625961	135	1.0	.50	
926	212	7886000	150	1.0	.40	
926	212	7886000	150	1.0	.40	

DATE	AREA	NUMBER	TIME	LEN.	COST	<3>BAND2
905	215	5621566	426	3.0	1.00	
922	301	4592280	247	6.0	2.20	
905	412	3918023	1157	4.0	1.50	
905	301	5492250	246	1.0	.50	
905	716	3258997	207	2.0	.80	
908	202	8726000	237	28.0	9.70	
914	301	9542250	154	3.0	1.20	
901	301	4595090	911	1.0	.50	
907	412	2449472	257	13.0	4.60	
907	412	2612364	230	1.0	.50	
911	301	4592250	302	3.0	1.20	
905	215	5621566	426	3.0	1.00	
922	301	4592280	247	6.0	2.20	
905	412	3918023	1157	4.0	1.50	
905	301	5492250	246	1.0	.50	
905	716	3258997	207	2.0	.80	
908	202	8726000	237	28.0	9.70	
914	301	9542250	154	3.0	1.20	
901	301	4595090	911	1.0	.50	
907	412	2449472	257	13.0	4.60	
907	412	2612364	230	1.0	.50	
911	301	4592250	302	3.0	1.20	

DATE	AREA	NUMBER	TIME	LEN.	COST	<3>BAND3
831	305	6243131	1026	5.0	2.00	
912	612	8295231	136	3.0	1.20	
830	305	9741380	1139	1.0	.50	
831	305	6243131	1026	5.0	2.00	
912	612	8295231	136	3.0	1.20	
830	305	9741380	1139	1.0	.50	

DATE	AREA	NUMBER	TIME	LEN.	COST	<3>BAND4
829	513	4337980	405	4.0	1.50	
915	404	3211089	1145	1.0	.50	
920	404	9876790	122	3.0	1.20	
921	312	9883556	1016	7.0	2.50	
829	312	2965050	252	6.0	2.20	
901	404	8672145	248	1.0	.50	
912	313	5636393	148	1.0	.50	
912	312	9712090	213	1.0	.50	
921	312	6925050	1012	6.0	2.20	
901	312	2965000	249	4.0	1.50	
907	312	2975050	218	1.0	.50	
907	313	3551209	526	1.0	.30	
907	404	3999000	553	10.0	2.30	
922	312	2973420	1043	1.0	.50	
919	714	7546707	222	1.0	.50	
829	303	8318888	1046	2.0	.90	
905	415	9612000	1239	1.0	.50	
907	415	9879000	254	2.0	.90	
912	408	9882900	141	1.0	.50	
913	408	2457798	157	1.0	.50	
828	408	2987790	5	4.0	1.10	
831	408	9845200	343	6.0	2.40	
901	213	2678900	1144	20.0	7.80	
906	213	7641700	151	1.0	.50	
921	408	2457789	506	2.0	.60	
921	408	2457789	506	2.0	.60	

DATE	AREA	NUMBER	TIME	LEN.	COST	<3>IDBD
901	416	6332574	413	2.0	1.10	
911	519	8232020	301	8.0	4.00	
918	416	3667645	938	1.0	.60	
921	416	3632574	929	6.0	3.00	
926	809	7739989	903	1.0	3.90	
901	519	8214500	908	10.0	5.00	
901	416	8639666	1052	11.0	5.50	
920	519	8212000	1010	5.0	2.60	
901	416	6332574	413	2.0	1.10	
911	519	8232020	301	8.0	4.00	
918	416	3667645	938	1.0	.60	
921	416	3632574	929	6.0	3.00	
926	809	7739989	903	1.0	3.90	
901	519	8214500	908	10.0	5.00	
901	416	8639666	1052	11.0	5.50	
920	519	8212000	1010	5.0	2.60	

DATE	AREA	NUMBER	TIME	LEN.	COST	<3>BANDO
822	203	2466481	353	15.0	1.10	
822	203	8664670	911	7.0	1.20	
826	203	5271181	807	5.0	.40	
829	203	2595278	1026	1.0	.10	
829	203	5328657	1015	5.0	.40	
829	203	6884076	1033	4.0	.70	
831	203	5498000	853	5.0	.60	
82	203	5498100	314	15.0	1.60	
810	203	5242183	409	1.0	.20	
810	203	5242183	410	1.0	.20	
819	203	5498000	5	3.0	.30	
821	203	8537762	1033	14.0	2.20	
823	203	5497869	758	1.0	.10	
827	203	2749090	953	13.0	1.40	

922	312	2973420	1043	1.0	.50
829	513	4337980	405	4.0	1.50
915	404	3211089	1145	1.0	.50
920	404	9876790	122	3.0	1.20
921	312	9883556	1016	7.0	2.50
829	312	2965050	252	6.0	2.20
901	404	8672145	248	1.0	.50
912	313	5636393	148	1.0	.50
912	312	9712090	213	1.0	.50
921	312	6925050	1012	6.0	2.20
901	312	2965000	249	4.0	1.50
907	312	2975050	218	1.0	.50
907	313	3551209	526	1.0	.30
907	404	3999000	553	10.0	2.30
922	312	2973420	1043	1.0	.50
922	312	2973420	1043	1.0	.50

<3>BAND5

DATE	AREA	NUMBER	TIME	LEN.	COST
831	805	9674068	742	11.0	2.80
84	714	5445077	1137	1.0	.20
828	408	8992900	420	1.0	.50
830	415	9561483	246	2.0	.90
831	408	2457709	339	2.0	.90
901	213	9896900	229	1.0	.50
901	714	7546547	440	6.0	2.40
905	213	9801200	149	2.0	.90
911	213	7641900	432	1.0	.50
918	714	5667800	139	4.0	1.70
919	714	7546707	222	1.0	.50
829	303	8318888	1046	2.0	.90
905	415	9612000	1239	1.0	.50
907	415	9879000	254	2.0	.90
912	408	9882900	141	1.0	.50
913	408	2457798	157	1.0	.50
828	408	2987790	5	4.0	1.10
831	408	9845200	343	6.0	2.40
901	213	2678900	1144	20.0	7.80
906	213	7641700	151	1.0	.50
921	408	2457789	506	2.0	.60
921	408	2457789	506	2.0	.60
831	805	9674068	742	11.0	2.80
84	714	5445077	1137	1.0	.20
828	408	8992900	420	1.0	.50
830	415	9561483	246	2.0	.90
831	408	2457709	339	2.0	.90
901	213	9896900	229	1.0	.50
901	714	7546547	440	6.0	2.40
905	213	9801200	149	2.0	.90
911	213	7641900	432	1.0	.50
918	714	5667800	139	4.0	1.70
926	203	2727894	352	2.0	.40
830	203	3434188	335	2.0	.70
830	203	3784641	422	1.0	.50
907	203	6237890	314	1.0	.40
921	203	3936820	420	1.0	.50
912	203	3786441	1050	1.0	.50
920	203	2678578	528	3.0	.30
822	203	2466481	353	15.0	1.10
822	203	8664670	911	7.0	1.20
822	203	2466481	353	15.0	1.10
822	203	8664670	911	7.0	1.20
826	203	5271181	807	5.0	.40
829	203	2595278	1026	1.0	.10
829	203	5328657	1015	5.0	.40
829	203	6884076	1033	4.0	.70
831	203	5498000	853	5.0	.60
82	203	5498100	314	15.0	1.60
810	203	5242183	409	1.0	.20
810	203	5242183	410	1.0	.20
819	203	5498000	5	3.0	.30
821	203	8537762	1033	14.0	2.20
823	203	5497869	758	1.0	.10
827	203	2749090	953	13.0	1.40
926	203	2727894	352	2.0	.40
830	203	3434188	335	2.0	.70
830	203	3784641	422	1.0	.50
907	203	6237890	314	1.0	.40
921	203	3936820	420	1.0	.50
912	203	3786441	1050	1.0	.50
920	203	2678578	528	3.0	.30
822	203	2466481	353	15.0	1.10
822	203	8664670	911	7.0	1.20

SUMMARY OF CALL ACTIVITY

WATTS	# CALLS	DURATION	TOTAL COST
BAND1	28	248.0	$46.00
BAND2	22	130.0	$47.40
BAND3	6	18.0	$7.40
BAND4	30	96.0	$34.40
BAND5	44	148.0	$56.20
IDDD	16	88.0	$51.40
BAND0	46	246.0	$32.20
TOTAL	192	974.0	$275.00

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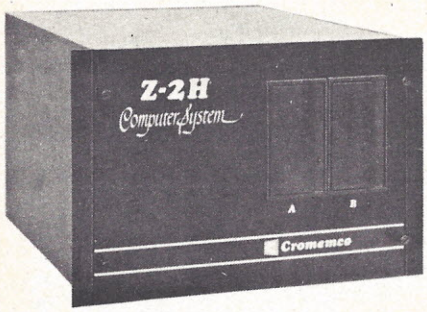

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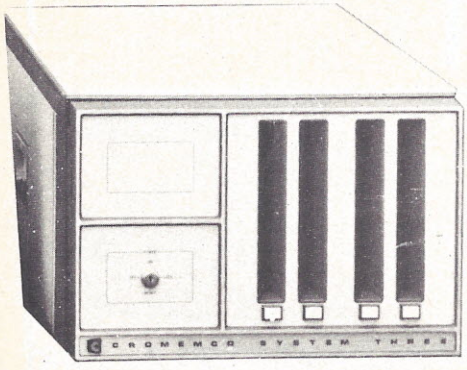

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32K, Quad Density, List $2629 2234

Kits incl. 4 edge connectors & 1 serial port.
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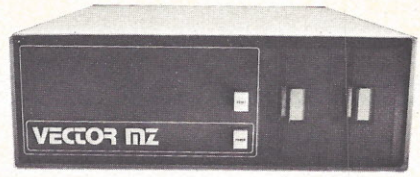

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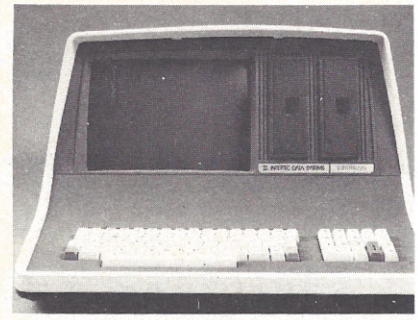

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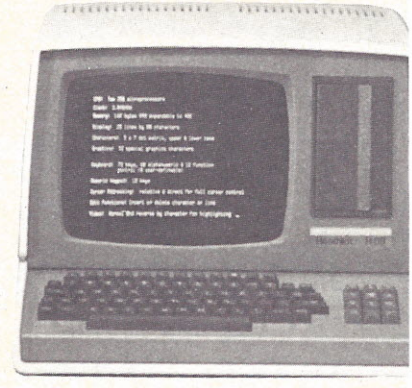

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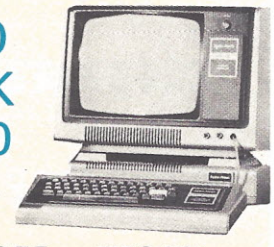

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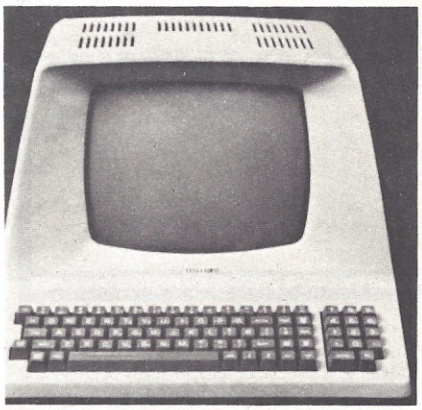

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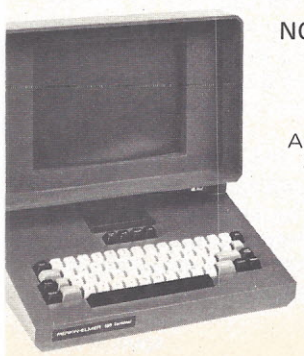

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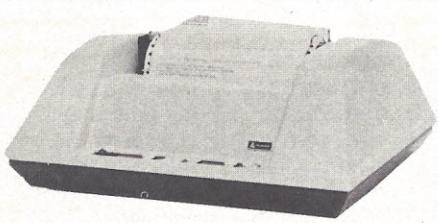

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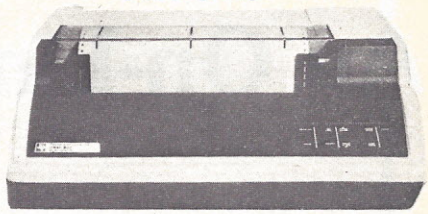

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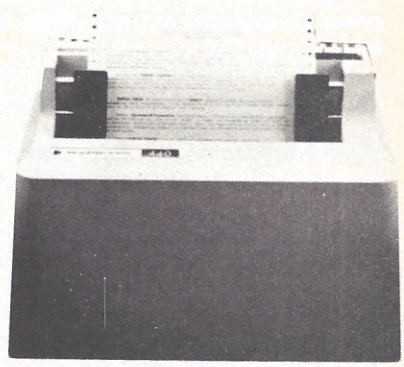

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An On-Line Character Recognizer

By Robert M. Simmons

This article presents an algorithm for a character recognizer, a graphics tool which is ideal for use with a digitizer tablet. Since the tablet is becoming a more popular graphics input device with microcomputer owners, the character recognizer (a program which enables the computer to read printed characters) is a tool which makes effective use of the tablet's potential.

This recognizer is a compact and efficient one, and can be programmed in a few hundred assembly language instructions. The algorithm is presented in pseudo-code so that the fundamentals of the algorithm will not be obscured by any particular programming language.

An increasingly popular peripheral for use with microcomputer systems is the digitizer tablet. Tablet components typically consist of the flat tablet plate, a stylus and a controller. In simple terms, the tablet functions by sending the X and Y coordinates of the stylus' position on the tablet surface to the host computer. The tablet can very accurately record any stylus movement; a typical resolution is 0.1 millimeters. In recent years, several companies have introduced tablets inexpensive enough to become popular with microcomputer owners.

The applications for the digitizer tablet are virtually unlimited, since the tablet can convey any information which can be represented in X and Y coordinates. Along with the on-line character recognizer, these applications include mathematical graphs, pseudo-keyboards, and electrical circuit design, to name a few. On-line character recognition (a subset of both automatic pattern recognition and artificial intelligence) provides several interesting issues to the programmer, and is a very powerful tool for use with the tablet.

In general, a character recognizer inputs a symbol constructed from a number of points from the tablet and matches that symbol to its corresponding alphanumeric character. Software which does this is not new; some very successful character recognizers have been developed over the years, but not for efficient use in microcomputer systems.

The beauty of a character recognizer lies in the fact that it permits the user to input all information, whether textual or graphical, with just the tablet. This is not to say that such a recognizer would eliminate the use for a keyboard, just that the keyboard would not be necessary for interactive graphic application. Putting down the stylus to hit a key, then picking up the stylus, then putting it down again, *ad nauseum,* decreases the interactive nature of most graphics applications.

Up to this point, it could rightfully be argued that a pseudo-keyboard would serve as much use as a character recognizer. (A pseudo-keyboard is basically a plastic overlay on the tablet which has the keyboard characters programmatically represented by boxes. Touching the stylus to a box would be analogous to hitting a key on the keyboard). However, the pseudo-keyboard monopolizes some useful space on the tablet surface which could be used for graphics data.

Besides, drawing a character on the tablet can convey several items of information: the alphanumeric character itself, the size of the character, and the position of the character on the tablet. Thus, by drawing the symbol in different sizes and positions, the same character can have many different and useful meanings to any applications program which uses a character recognizer.

There are several desirable characteristics of any character recognizer. For one thing, it must be fast (quick response is a requirement for interactive graphics). It must also be consistent and, at the same time, forgiving. That is, the recognizer must be very flexible in deciphering different printing styles, and it should also be able to recognize at least 90% of the characters drawn (the 10% missed is accounted for by sloppy printing and other factors). Toward this end, the recognizer should be trainable. This attribute allows the program to learn the style of each user, rather than forcing the user to learn to print in some particular style which the program knows.

Lastly, and perhaps paramount when speaking of the implementation of a character recognizer on a microcomputer, the program must not use an inordinate amount of the computer's resources, primarily programmable memory. The algorithm described here incorporates all of these characteristics to a high degree.

The computer system used to develop this recognizer consisted of a BYTE mainframe with a Z-80 processor and 32K of programmable memory, a TV monitor, a keyboard, and a Bit Pad digitizer tablet. A floppy disk drive was used to store the software. The CP/M operating system supported EBASIC and 8080 assembly language.

This character recognizer algorithm consists of four main modules: a data collection routine which accepts the data from the tablet; a feature extraction routine which expresses the data in a set of properties which distinguishes one character from all others; a lookup routine which tries to find a match for the input character in a table of characters; and a training routine which allows the user to build a table of characters which matches his own printing style, and which the lookup routine can successfully recognize.

The algorithm will be presented in pseudo-code, rather than restricting it to a particular applications language. Relative merits for any applications language can be argued, but one point is important to remember: The language chosen must be fast enough to collect at least half the points sent by the tablet. This insures that the feature extraction routine is able to extract all important characteristics of the printed symbol.

When I developed the program, EBASIC proved to be too slow for this purpose because it jumped back to the operating system after each instruction to test for keyboard input. This resulted in only 10% of the points from any drawn character being received by the program. Writing the data collection routine in assembly language alleviated the problem.

DATA COLLECTION

The data collection algorithm is straightforward: Start collecting data from the tablet when the user begins drawing the symbol and collect data until the symbol is finished. The start of the data collection can be programmed to operate either in polled or interrupt mode. Deciding when the symbol is done is the most important portion of the routine, because the user must have enough time to finish printing the character before the recognizer processes it.

This algorithm, like those of the majority of character recognizers, considers the symbol to be complete when the stylus has been lifted for a half-second. This allows the user to draw characters using more than one stroke. The timing loop to wait a half-second is easily implemented by incrementing a count value; when that count reaches a predetermined maximum value (which will vary depending on the speed of the language used), the half-second is up.

Data Collection Routine (Polled Mode)

```
max = (value); count = 0
while count < max
do
  while no input data from tablet
  do
    increment count
    if count ≥ max then exit
  end do
  input point from tablet
  store point in array
  count = 0
end do
exit
```

Data Collection Routine (Interrupt Mode)

```
Driver:
        max = (value)
        count = 0; reset flag
        while count < max
        do
          increment count
          if flag is set then
            count = 0
            reset flag
        end do
        exit
Interrupt Handler:
        set flag
        input point from tablet
        store point in array
        return from interrupt
```

FEATURE EXTRACTION

The feature extraction routine is called after the user has finished printing the character. The purpose of the routine is to order the data from the printed character into one or more properties which help to uniquely identify that character. Most feature extraction routines look at the areas visited by the points in the character; this algorithm is no different. Specifically, the minimum and maximum X and Y values are determined, in effect drawing a rectangle around the character. That rectangle is then divided into nine equal regions, and each point in the data collection array is "mapped" into the appropriate region, in the order in which the points were collected.

In essence, the feature extracted from the data is a map of the regions which the character visited, in the order in which they occurred. The region for any point is added to the map only if it is different from the last region to be visited. This region number can range in value from 0 through 8, and so can be represented in four bits. Two regions can thus fit in each 8-bit word, and the map for any character can fit in ten words (20 regions visited). An example of this is the letter "C" (see Figure 1). The map for this character would be 8763012, assuming the letter was drawn in a counterclockwise fashion.

Feature Extraction Routine

```
determine xmin, xmax, ymin, ymax
test for dot, horizontal line, vertical line
calculate region boundaries
map = blanks
old region # = 9
for each data point in array
do
  determine region # for point
  if region # not = old region # then
    add region # to map
    old region # = new region #
end do
exit
```

Two additional points are worth noting. First, determining the region number for each point does require a multiply and divide capability, but a floating-point capability is not required (nor does it enhance the algorithm). The region boundary problem can be simply expressed as follows.

The respective distances between the X and Y boundary lines are

$$DX = ((XMAX - XMIN) \text{ DIV } 3) + 1$$
$$DY = ((YMAX - YMIN) \text{ DIV } 3) + 1$$

Each of the nine boxes in the rectangle measures DX by DY (see Figure 2). Then, for each X and Y point,

$$\text{REGION \#} = ((Y - YMIN) \text{ DIV } DY) * 3 + ((X - XMIN) \text{ DIV } DX)$$

Notice that the "DIV" function is simply an integer divide. In the formulas to calculate DX and DY, the "+ 1" forces the region number for any point to the range 0-8. This prevents the region formula from miscalculating the region number for any points which lie on the lines X = XMAX and/or Y = YMAX.

The second important point is the test for a dot or line. These special cases do not fit the region boundary problem very neatly, and so should be treated separately. The test for a dot is $(YMAX - YMIN) < \in$ AND $(XMAX - XMIN) < \in$, where $\in$ is some limit, say ten units for a tablet with 0.1 millimeter resolution. The test for a horizontal line is $(YMAX - YMIN) < \in$, and for a vertical line is $(XMAX - XMIN) < \in$. The value of $\in$ can vary for any of these cases, depending on how tolerant the routine must be in handling dots and lines. This special handling will allow any applications program to treat these symbols as control characters, graphics data, or any sort of delimiter.

TABLE LOOKUP

The lookup routine is used by both the training module and the applications program, and involves a sequential table lookup of existing letters and their corresponding maps. The table consists of a number of rows of eleven words each, one row for each letter that the recognizer "knows." Each row consists of one word for the ASCII character and ten words for the corresponding map.

The size of the table (hence the number of available rows) depends on the number of characters desired in the recognizer's "vocabulary." The lookup routine takes the map of the input character and compares it against the entries in the table. If a table entry can be found which is a subset of the new map, then a match exists and the lookup routine has a "guess."

In order to be as flexible as possible in recognizing the character, the term "subset" is given a broad definition. In this application, all that is required for map 1 to be a subset

of map 2 is that map 1 must exist somewhere within map 2, in the same sequence. That is, for map 1 ($a_1a_2a_3a_4a_5$) to be a subset of map 2 ($b_1b_2b_3...b_n$), then the letters a_1 through a_5 must be present within the string $b_1b_2b_3...b_n$ in the same order, though not necessary in contiguous order. To illustrate this, map 1 contains the string 2587. That map would be a subset of any of the following maps:

map 2 — 1*2587*
map 3 — *258*730
map 4 — 1*25*1*87*
map 5 — 64*258*730

because each map contains the numbers 2, 5, 8 and 7 in that order. This flexibility allows for sloppy printing (up to a point) or any other factor which might cause the printed character to deviate from the user's ideal printing style.

To facilitate this table lookup method, the table is sorted by the length of the map, in descending order. This strategy prevents a character from being mistaken for one whose map is a subset of the correct one. For example, if the map of the input character was 6301258 and the table was in ascending order like the one below,

L 63012
U 6301258
O 763012587
Q 76301258752

then that input character would always reach the map for "L" before it reached the correct map for "U". As a result, the letter "U" would always be incorrectly identified as an "L", since 63012 is a subset of 6301258. The same would be true for the letters "O" and "Q".

Keeping the table in descending order prevents this. Using the previous example in reverse order, the map for the input character is 6301258 and the table contains

Q 76301258752
O 763012587
U 6301258
L 63012

Since the maps for "Q" and "O" are longer than the input map, they cannot be subsets. Thus the match would be "U" since 6301258 is very definitely a subset of 6301258.

Table Lookup Routine

```
point to first row in table
while more rows are present in table
do
  get map of current row (map 1)
  if map 1 is subset of input map then
    letter = character of map 1
    exit
  else
    point to next row in table
end do
letter = unknown (no match)
exit
```

Notice that if no match can be found, then a value which flags the error condition is returned. Thus the applications program can ignore the input, treat it as graphics data, or signal the user to try again (depending on the application), and the training program can query the user for the correct answer.

TRAINING

As mentioned earlier, the training routine allows the character recognizer to "learn" the printing style of the user. This is done by familiarizing the routine with each character in the user's alphabet. With this particular algorithm, it is desirable to fill the user's table with the "ideal map" for each character, such that the map for each character in the table would maximize the recognition success for the future characters. In other words, this training routine allows the user to include in the table those maps which the user feels will be a subset of the input characters' maps at least 90% of the time.

This routine will allow the user to choose the maps for his characters, and to change them as often as necessary to obtain the desired table of maps. At times, simple characters such as I or J will require only one try to get the "ideal map," but other more complicated characters such as A, B, M or W might require several iterations before the correct pattern is recognized. The training module requires no *a priori* knowledge on the part of the user other than an understanding of how the map is derived from the drawn character.

The training routine is in itself an interactive graphics program. After the character has been printed, the map for the input character is output to the user's console, and the lookup routine is called to try and identify the character. If no guess can be made as to the character's identity (this occurs either the first time the character is drawn or if the character deviates from the user's printing style), then the user is asked to respond with the correct letter.

The program then asks if the map for the input character is satisfactory. This means that the user has the opportunity to perform "quality control" checks on the maps going into the table. If the map is not satisfactory, then the user may enter his own map after he sees the pattern in the letter. For example, printing "A" 10 times might result in 10 slightly different maps, but there is at least one set of regions in each map which is a subset of all 10 maps, and so would be the ideal map to enter into the table.

In any case, the specified map is added to the table, and any existing map for that character is deleted. The user can also tell the program to ignore the character; this allows the user to avoid adding any map to the table which does not represent the way that particular character will be drawn. Thus any amount of experimentation is possible.

If the program is able to match the input character with one in the table, then the program's guess is output and the user is given a chance to respond "yes" or "no" to the guess. If "yes" is responded, the program either transfers to the data collection routine to wait for the next character, or terminates if the user is finished. A response of "no" results in the user being given a chance to tell the program either to ignore the character, or to tell the program the correct character so that the table will be updated.

Once the user is satisfied that the table contains the proper maps for all desired characters, he may command the program to save the table in a permanent file. This means that the user has to run the training routine only once; on subsequent occasions the applications program can read the table from the file and merely invoke the lookup routine to recognize the characters.

Training Routine

```
reset done flag
while done flag is not set
do
  call data collection routine
  call feature extraction routine
  output map to console
  call table lookup routine
  if no guess then
    inform user
    input letter from user
    if blank (ignore) then
      do nothing
    else
      ask user if map is satisfactory
      if not satisfactory then
```

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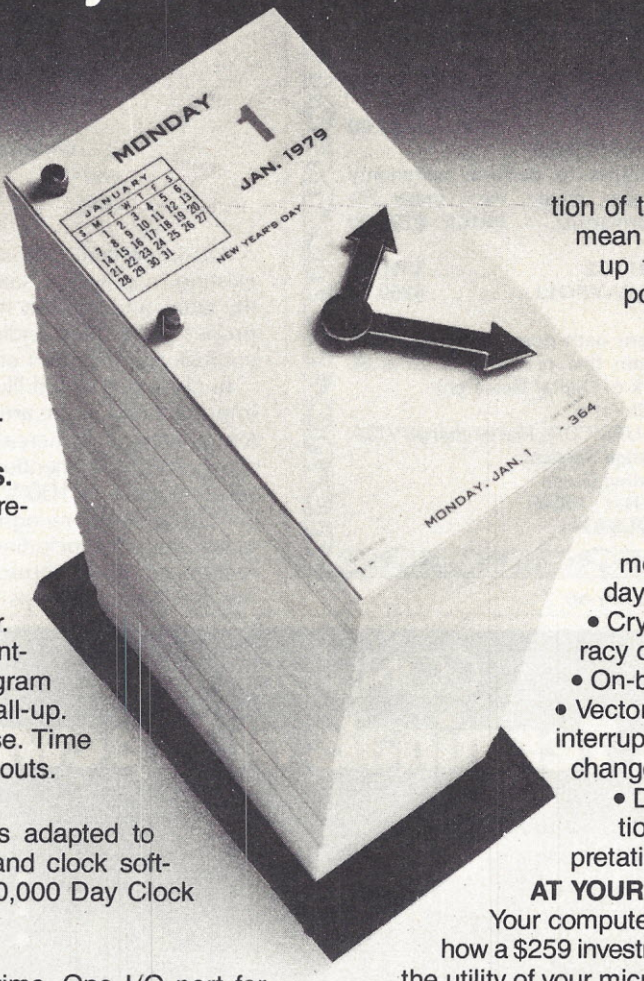

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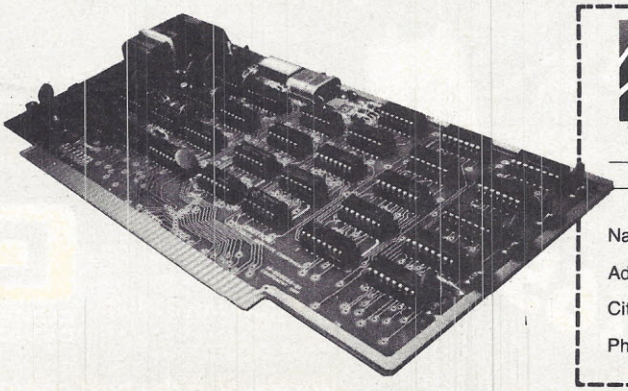

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```
            input map from user
            update table with map
        else
            output guess to console
            input "yes" or "no"
            if "yes" then
                do nothing
            else
                input letter from user
                if blank (ignore) then
                    do nothing
                else
                    update table with map
        ask user if done
        if user is done then
            set done flag
            write table to file
    end do
    stop
```

It is important to note that when updating the table, any existing map for the same character must be removed from the table, and the new map must be added to the table in its proper place (descending order). This will prevent future confusion on the part of the lookup routine.

In closing, I would like to point out that the user plays an important role in the area of character recognition. A consistent printing style increases the effectiveness of any character recognizer, and attention to detail in the training phase can result in close to 100% character recognition success.

This particular recognizer can be programmed to operate in less than 2K, including the table. This makes the character recognizer an economical tool for anyone who wishes to use the digitizer tablet to its full potential.

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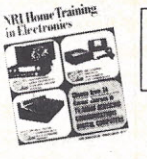

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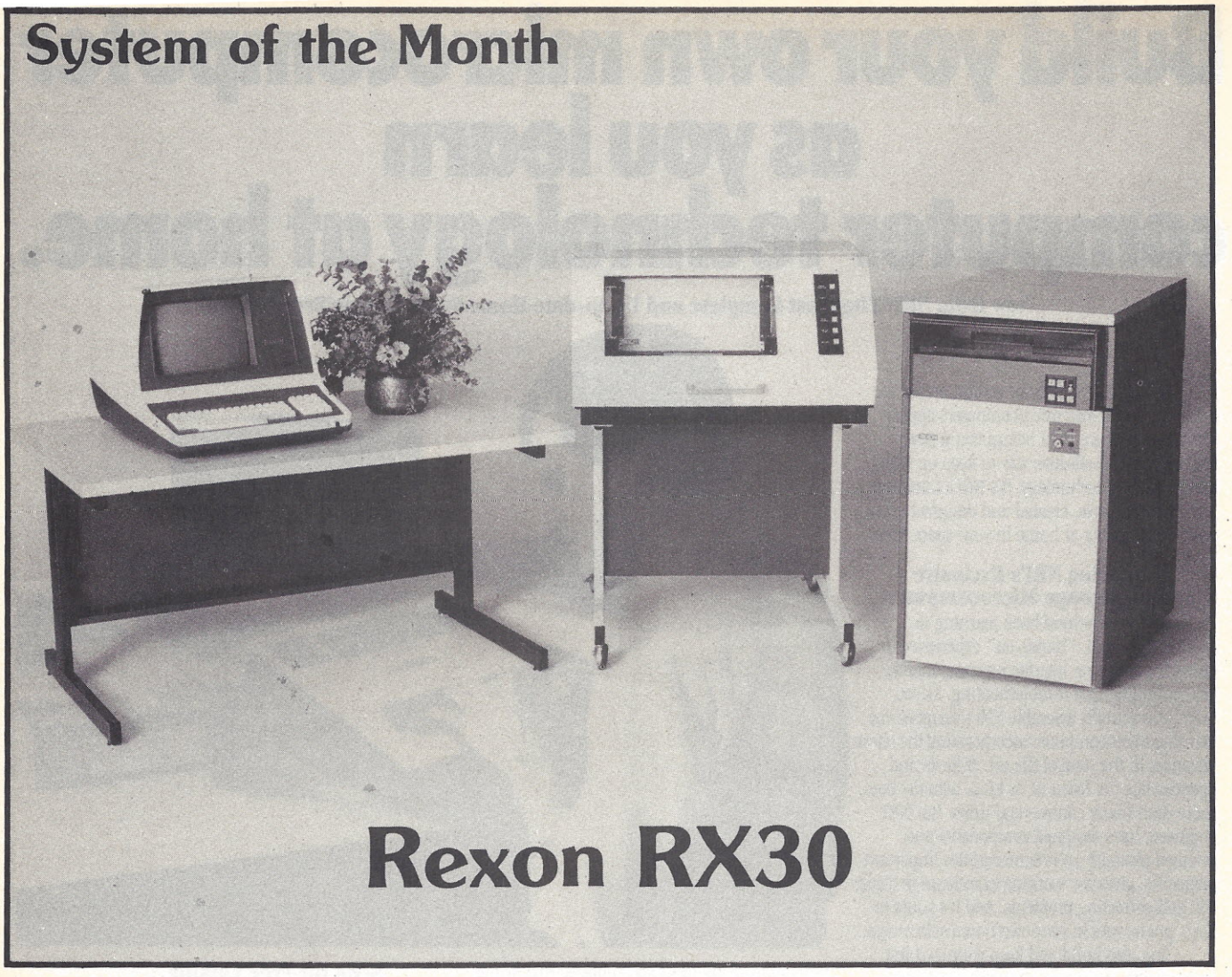

Rexon RX30

By Tom Fox, Systems Editor

New computers that aim to capture the small businessman's heart are far from rare these days. Finding a company who is marketing one in the "old fashion way," though, is an event worth attending. We are literally surrounded by software and hardware catalogs; so much so that it's easy to forget that only a handful of years ago, calling oneself a computer company meant a lot more than offering a mail-order memory board or billing program.

During those earlier years, being in the computer business implied that the company supplied all aspects of the product: hardware, programs, nationwide service, documentation and a network of stores featuring technical training seminars for their impeccably attired sales personnel.

Such a company is Rexon, and it is to their credit that they spent millions of dollars setting up a development, manufacturing, service and dealer organization even before the first product was shipped. The course for Rexon was mapped by its president Ben Wang, Ph.D., who in the 1960s founded (and subsequently sold) Wangco Incorporated, along the way designing some of today's industry-standard magnetic tape drives, floppy disk mechanisms and hard disk machinery.

Rexon's aim is to be a "comprehensive" computer company — a mini-IBM, if you will. They have zeroed in to the market segment developed largely by Basic/Four, a successful California maker of computers and computer solutions. The subject of this month's analysis is the RX30 Multi-Terminal System, called the "Marathon" in their national magazine advertisements. Rexon claims that the RX30's performance is superior in many ways to the Basic/Four product. It is certainly a more up-to-date design.

HARDWARE

The people at Rexon feel very strongly that they are in the business of selling packaged "solutions" to business problems, rather than mere computer machinery. As a result, it's a little difficult to extract from them a detailed description of the hardware innards of the RX30. Even so, INTERFACE AGE readers, we believe, are a cut above the average "don't bother me with details — just make it work" purchaser, and deserve to know some of the operating details of the expensive equipment they might be buying.

For one thing, very few computer builders have the capabilities to manufacture complex and specialized peripheral devices such as printers and disk drives. Knowing the origin of these critical elements can be an important part of deciding between competing computer brands. So let's dig into the RX30 Multi-Terminal System.

A bare-bones single-user system consists of three elements: a Central Station in an appealing 38" high cabinet (about the size of a short refrigerator), a CRT terminal and a printer. Rexon is quick to point out that the basic Central Station is equipped with the hardware and software to support up to three additional CRT terminals and a second printer.

The Central Station consists of a metal cabinet topped by a

(nearly) 20-megabyte dual-platter hard disk drive. The front of the cabinet swings open for access to a vertically mounted 6-slot mother board. Into this board are plugged the Executive Processor card, a Memory Module card, a Disk Controller card and a Device Adaptor card to connect it to four CRT terminals and two printers. Room remains for an additional Memory Module and Device Adaptor card, doubling the size of the Random-Access Memory (RAM) and number of terminals, respectively.

In keeping with Rexon's "total responsibility" concept, the plug-in electronic cards conform to no known industry-wide standards of interconnection (such as the familiar S-100 bus). Even such common things as printers and CRT terminals must be officially Rexon-supplied.

The Executive Processor board is right up with today's state of the art in that it utilizes Intel's 8086 16-bit microprocessor chip. This processor runs at a cycle rate of five megaHertz, and performs basic operations — such as ADD and LOAD — up to six times faster than the 8-bit Basic/Four computer, according to the manufacturer's testing.

The Memory Module is a 64-kilobyte design utilizing dynamic RAM chips to minimize power consumption and heat buildup. Up to two of these boards can be plugged into the system for a total of 131,072 bytes (characters) of fast storage. The Central Station features eight hours' worth of battery backup for the RAM to protect the integrity of information that is stored there. This doesn't mean that the computer will continue to run during a power brownout or blackout, but it provides a means to retain any data or programs until the power returns and they can be safely copied onto the disk.

The Disk Controller is a single-card design that will support up to two of the 20-megabyte hard disk drives simultaneously. It incorporates the popular Direct Memory Access (DMA) feature, which frees the main 8086 computer chip from the repetitive task of moving data between the disk and random-access memory.

The Device Adaptor is actually a six-port Input/Output (I/O) card to provide communication between the computer and human-readable devices. It includes four RS-232 compatible serial I/O ports for connection with the CRT terminals, as well as a pair of Centronics-compatible parallel I/O ports for connection with the system printer(s). A second Device Adaptor (less the parallel ports) is available when it comes time to add the fifth through eighth CRT terminals.

The disk drive, not surprisingly, is Dr. Wang's own design, now supplied to Rexon by Wangco/Perkin-Elmer. It features a fixed disk platter and removable cartridge, each with a usable capacity of 9,562,112 bytes. With a moving head access time of 10 milliseconds track-to-track and 2400 rpm rotational speed, the read/write head can position itself over any piece of data in an average of 47.5 milliseconds. Computer users accustomed to floppy disk drive delay times soon become spoiled after they spend a little time with performance such as this.

The removable disk is an IBM 5440-type cartridge that slides into the top of the drive. There's an interesting circuit that senses the temperature of the removable cartridge interior and keeps the delicate read/write heads safely holstered unless the cartridge and drive are nearly the same temperature. So if you insert a cartridge that has been cold-soaked over a winter's night in the car trunk (a practice we would *never* advise), expect to wait many minutes for temperature stabilization before the drive will start up.

Rexon's CRT terminals are modified versions of the ADDS Regent 25. They provide the near-industry standard 1,920 characters of display in a 24 x 80 format. The keyboard features four user-definable keys that can help solve the operator training problem, if applied cleverly by the programmer.

Switch-selectable white-on-black or black-on-white display is a particularly nice feature. (It is reported that a few years ago, a major computer manufacturer spent a lot of money trying to determine whether white or black characters result in the least operator eyestrain. The outcome of the study was disappointingly inconclusive; but the experimenters noticed that just making the black/white switch available to the test subjects markedly improved their comfort — proving once again that we all want to exercise some control over our own environment).

With regard to printers, Rexon has a selection of two of the best currently available designs. The basic unit is the Texas Instruments TI810, a lightweight serial dot-matrix machine. The high-speed choice is a Printronix 300 lines-per-minute dot matrix design. Surprisingly, Rexon's catalog does not yet include a letter-quality fully-formed character printer, or the word processing program to make it useful.

SOFTWARE

Each RX30 is delivered with a copy of RECAP, a combination disk operating system, BASIC language and utilities package. The operating system takes care of the multi-terminal operations, such as allocating scarce system resources to the various users as they demand them. Disk files can be of either the sequential or random access (direct) type.

If the latter is utilized, the applications programs have the option of locating the various file records via a simplified VSAM type of indexing arrangement. This means that data records can be located far more quickly than if a tedious sequential search is used. VSAM (a version of ISAM, for Indexed-Sequential Access Method) takes on new importance when large disk drives such as the RX30's are fitted to a computer.

RECAP occupies 24 kilobytes of the available memory space, leaving approximately 10 kilobytes of memory for each of the four or eight terminals. The memory allocations can be tailored to the application, giving more or less memory to a particular user as needed. Ten kilobytes isn't an overly generous amount, particularly when you consider that the applications programs are written in interpretive BASIC and cannot be reentrant, thus requiring that each user maintain a copy of the source program in its memory partition at all times. Applications written for the RX30 tend to be many small programs that are CHAINed from each other as the job progresses.

Programmers used to Basic/Four equipment should be very comfortable with Rexon's Business BASIC. Since this language was intended to accept Basic/Four applications programs with only small changes, it's little wonder. Business BASIC is a line-by-line interpreter that includes some nifty editing and debugging features to increase a programmer's efficiency. The ability to globally replace variable names in the source program is nice, as is the line renumbering utility.

Certain of the system utilities are actually BASIC programs which must be loaded from the disk and run in order to perform functions such as copying disk files and displaying their contents on the terminal. To one who is used to listing a directory of disk files by simply typing DIR, it's a bit annoying to have to enter NEW, then RUN"***", and *then* answering four separate inquiries to perform the same function.

One of Rexon's software tricks which really caught our eye was IDOL (Interactive Definition-Oriented Language). IDOL was written a couple of years ago by DTI of Riverdale, Maryland as a Data Base Management System for the Basic/Four computer. It is actually a family of BASIC programs which has recently been adapted to the RX30. IDOL is a remarkably efficient tool for writing certain types of database manipulating applications programs. It provides a painless means to create user selection menus and includes all the hooks needed to enter/update/delete/search/print data records whose definition can be made up by the applications programmer.

Multi-user interlocks are featured, as is password protection that can be freely applied. As an application is created on IDOL, the language automatically generates user and maintenance documentation, complete with an index and a table of contents. IDOL advocates claim they can create an end-user application 60 to 70 percent faster than writing custom BASIC programs — a real eye-opener for software managers everywhere.

No real "applications" programs have been mentioned, such as General Ledger, Payroll, etc. Dr. Wang has covered this

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base, too, but in a rather unusual fashion. His secret is to capitalize on a large population of programs that have been developed over the past several years by Basic/Four dealers and software houses. Providing that the users will attest to sole ownership of an end-user program, Rexon will convert it to RX30 Business BASIC at their factory in Culver City, California.

They have developed a computer program which handles 95 percent of the conversion automatically, with the rest being the responsibility of the software staff at Rexon. The manufacturer has pledged its assistance in making these transplanted jewels available to computer purchasers via their dealer network.

THE PRICE OF ATTENTION

About $35,000 will get you a two-terminal RX30 with 64 kilobytes of memory, a 20-megabyte disk drive and TI810 printer. The fare includes installation, training and a lot more hand-holding than most computer stores are able to provide these days. All of the Rexon-supplied software described above is incorporated, even IDOL, which by itself lists for $6,500 from DTI.

What do you get for this price? An excellent computer, to be sure, and a useful set of systems software upon which to build programs that apply to your business. If the preceding sentence is a full description of your computer needs, then we can think of several other machines that can do the same things at a much lower cost. If, however, doing business with a full-capability and full-service corporation is important to you, the price takes on new meaning.

There are many computer purchasers who, for their own good, should not buy machinery from computer stores and take them to their office to assemble like an electric train set. If you are not ready to take on the stupefying task of becoming an "instant" computer expert, the best decision you could make today would be to admit it to yourself, and go see someone like Rexon for your computer needs.□

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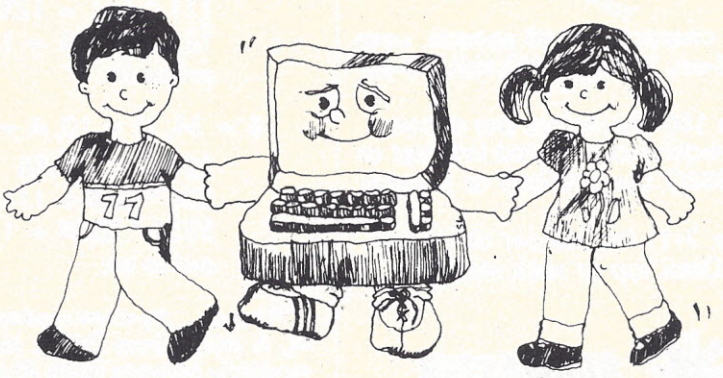

By Bob Albrecht

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Our next number pattern program will generate any of the sequences shown in previous episodes, and lots more. Each sequence is defined by four numbers, S, M, A and B.

S is the first number in the sequence. To get the next number:

1. add A to the previous number,
2. multiply the result of step 1 by M,
3. add B to the result of step 2.

In BASIC, S = M*(S + A) + B

The following table (Table 1) shows the values of S, M, A and B for some of our previous sequences.

Table 1.

SEQUENCE	S	M	A	B
1,2,3,4, ...	1	1	1	0
2,5,8,11, ...	2	1	3	0
1,2,4,8, ...	1	2	0	0
11,111,1111, ...	11	10	0	1
32,332,3332, ...	32	10	1	2
34,334,3334, ...	34	10	-1	4

Your turn. What are the values of S, M, A and B for each of the following sequences?

1. 1,3,5,7, ...
2. 3,6,12,24, ...
3. 43,433,4333, ...
4. 12,102,1002, ...
5. 1,5,13,29, ...
6. 1,12,34,78, ...

The following program reads S, M, A and B from a DATA statement, then starts the pattern defined by those numbers.

```
100 REM***NUMBER PATTERNS #5
110 DEFDBL S,M,A,B
120 CLS

200 REM***READ FOUR NUMBERS WHICH DEFINE PATTERN
210 READ S,M,A,B
220 IF S = 1E37 THEN PRINT "I'M OUT OF PATTERNS" ; END

300 REM***SHOW THE LATEST NUMBER, S
310 PRINT S

400 REM***WAIT FOR KEY PRESS, 'SPACE' OR 'Q'
410 KEY$ = INKEY$ : IF KEY$ = "" THEN 410
420 IF KEY$=" " THEN 510
430 IF KEY$="Q" THEN 120 ELSE 410

500 REM***COMPUTE NEXT NUMBER IN PATTERN
510 S=M*(S + A) + B
520 GOTO 310

900 REM***VALUES OF S,M,A,B
910 DATA 1,1,1,0
920 DATA 2,1,3,0
930 DATA 1,2,0,0
940 DATA 11,10,0,1
950 DATA 32,10,1,2
960 DATA 34,10,-1,4
970 DATA 1E37,1E37,1E37,1E37        End of data flags.
```

Several of the sequences we have used produce interesting patterns when each term of the sequence is squared. Here are some examples.

$11^2 = 121$
$111^2 = 12321$
$1111^2 = 1234321$
and so on.

$34^2 = 1156$
$334^2 = 111556$
$3334^2 = 11115556$
and so on.

$98^2 = 9604$
$998^2 = 996004$
$9998^2 = 99960004$
and so on.

$12^2 = 144$
$102^2 = 10404$
$1002^2 = 1004004$
and so on.

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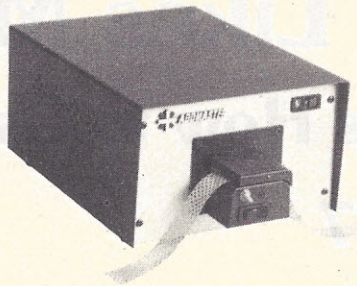

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CIRCLE INQUIRY NO. 1

Your turn. Write a program to:

1. READ the values of S□M, A and B which define a sequence.
2. Show the first term and the square of the first term.
3. If the user presses the space bar, compute and show the next term and its square.
4. If the user presses 'Q', go to step 1.

A RUN of your program might look like this:

S = 11, M = 10, A = 0, B = 1

11 * 11 = 121
111 * 111 = 12321
1111 * 1111 = 1234321
and so on.

S = 34, M = 10, A = –1, B = 4

34 * 34 = 1156
334 * 334 = 111556
3334 * 3334 = 11115556
and so on.

Hmmm. . .try some random patterns. Instead of reading S, M, A and B from DATA statements, generate their values randomly between limits (0 to 9?).□

Copies of "My TRS-80 Likes Me," Parts One and Two are now available free from Radio Shack. Interested persons should write to Sharon Ross, Radio Shack Circulation Dept. 3, 1300 One Tandy Center, Fort Worth, TX 76102.

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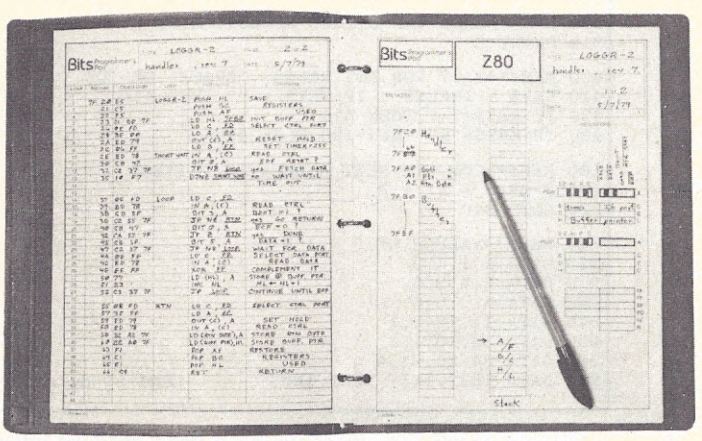

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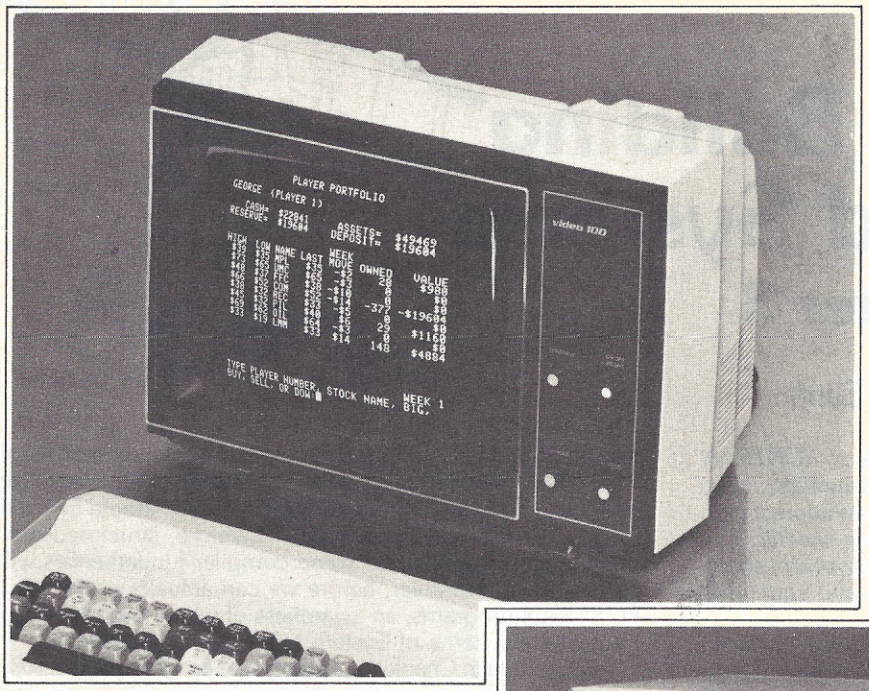

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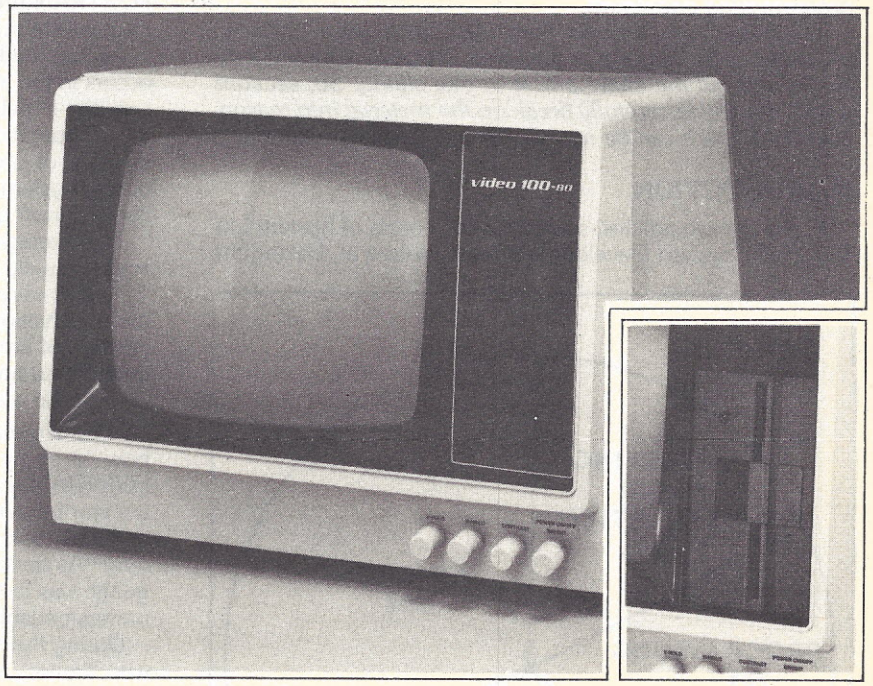

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Using and Building Micro-Based Systems

Chapter 3

By David Marca, Associate Editor

This chapter deals with the fundamentals of FORTRAN programming. In order to teach these fundamentals, many programs were developed to give the reader an appreciation of actually using FORTRAN statements. One specific program is created and enhanced throughout this article, showing the use of many FORTRAN statements and structured programming constructs.

This article was written for those who can sit down and actually develop the program as they read. Naturally, one is not expected to read the entire article in one sitting. So, sections within the article carefully break up the material into reasonable units which can be read and programmed in one sitting.

INTRODUCTION

In the last two articles, some basic concepts of System Life Cycle and System Development were looked at. During the next two articles, I will concentrate on the fundamentals of FORTRAN programming. This article will present primitive FORTRAN programming statements as they should be used to develop structured programs. Therefore, structured programming constructs and some compiler fundamentals will be discussed. However, before we can actually start writing FORTRAN programs, an awareness of where programming fits into the scheme of System Life Cycle is important.

As described in Chapter 1, January, the programming activity occurs in the Implementation phase of System Life Cycle. The activities of defining the program's operation and representing those operations in a computer-based language are the essence of programming. This means that a design of the *overall* system, and a specification of the general functions of the program are completed before programming occurs.

The average time needed to develop programs for a system is usually 20% of all System Life Cycle activities, Figure 1. These very rough approximations were arrived at based on observations of large software projects.[1,2] Since a fair amount of time is spent programming, it would be helpful to understand and know how to apply a computer language to a particular class of problems.

For the remainder of this tutorial, I will be concentrating on how to apply FORTRAN to represent problem solutions. FORTRAN is a very interesting language because it has had a major influence on programming. It was initially developed in 1954, and first called IBM's FORmula TRANslating System.[3] As denoted by its name, the major purpose of the language was to translate mathematical formulas into a machine-understandable representation.

During that time, knowledge about programming languages was limited, and machine resources were costly, so the

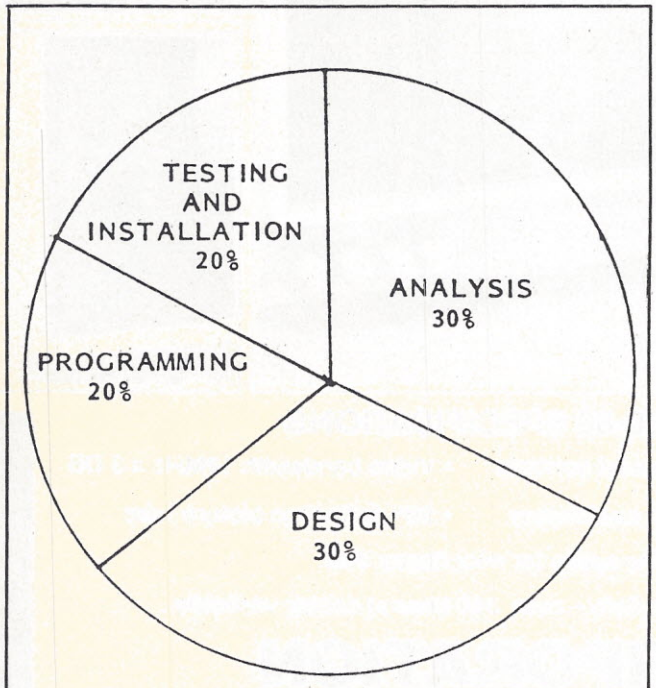

Figure 1. Time Spent in System Life Cycle Activities

```
00100   C-----------------------------------------
00200   C  NAME: NAME OF PROGRAM GOES HERE
00300   C  PURPOSE: OVERALL PURPOSE OF PROGRAM GOES HERE
00400   C  DESCRIPTION: DESCRIPTION OF PROGRAM FUNCTIONS
00500   C                GOES HERE
00600   C  NOTES: ANY NOTES AND COMMENTS GO HERE
00700   C-----------------------------------------
00800   C
00900           DEFINITION STATEMENTS GO HERE
01000   C
01100   C . . . . . .
01200   C
01300           EXECUTABLE STATEMENTS GO HERE
```

Figure 2. Program Template Built Using Comment Statements

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language has some serious problems with being unstructured and hard to read. I will, however, compensate for language deficiencies by using some well-known techniques for making the language easier to use.

The actual version of the FORTRAN language we will be using exclusively for all examples is Microsoft's FORTRAN for the TRS-80. I will limit the use of statements to very simple forms so that the concepts discussed and programs written will operate on most machines.

Before the first program is written, it is important to become familiar with the way the computer allows a programmer to build and print files. The best test of this will be to actually build a *template* file representing a block comment area of future FORTRAN programs. This way a file will be built that can be used later as well as testing program development tools now. The FORTRAN statement that must be known in order to construct the template, is the COMMENT statement.

Very simply, the COMMENT statement is denoted by the character "C" in column one of the line, and any other characters following the comment character are then ignored by the compiler. The basic template I will use, Figure 2, clearly identifies the program, tells what it does, and graphically separates FORTRAN statements that define data from those statements that operate on the data.

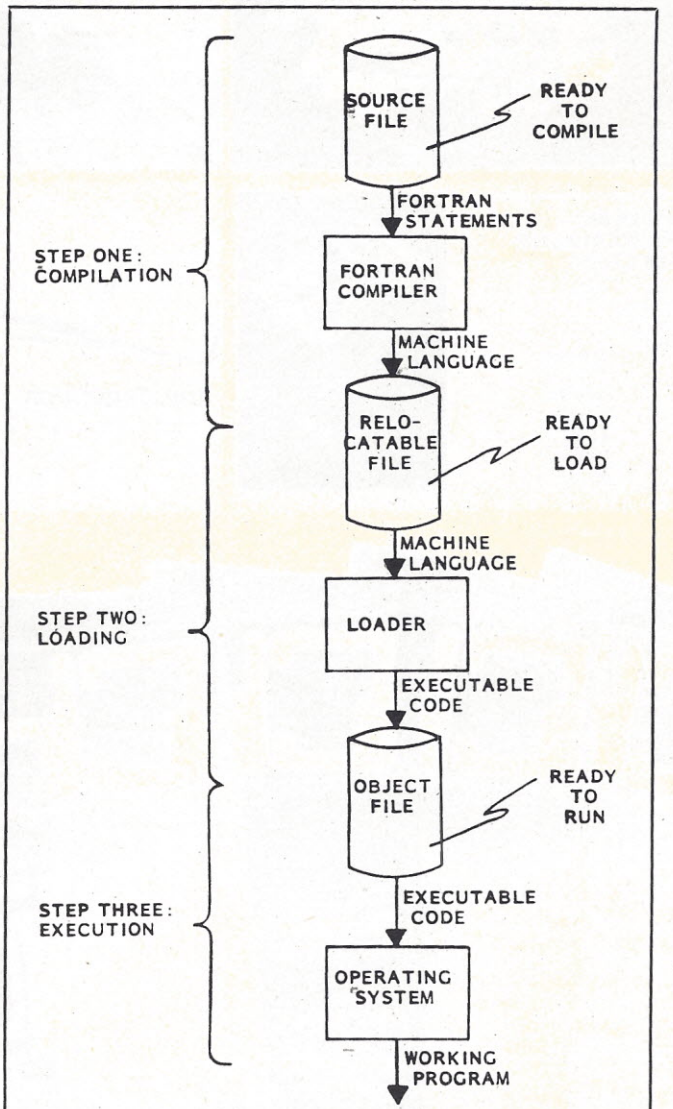


Figure 3. The Process of Translating FORTRAN Statements Into A Working Program

After learning how to create and print files containing program statements, the next thing to do is to add FORTRAN statements which will make the program actually work. Getting a file of FORTRAN statements into a working program takes a few steps, Figure 3. The first step involves compiling (translating) the FORTRAN statements into machine (TRS-80 in this case) language statements. The file containing this machine language is called a *relocatable* file.

The second step takes the contents of the relocatable file and puts it into a format which can actually run on the computer. The step is called LOADING, and it creates an *object* file.

Finally, the last step involves simply executing the program contained in the object file. This is done on the TRS-80 by simply typing in the name of the object file to the operating system.

To test out this sequence of steps, the template file can be modified and the minimum necessary FORTRAN statements added to produce a working program, Figure 4. These are the STOP and END statements. The STOP statement will tell the *operating system* to terminate the execution of the program. The END statement tells the *compiler* that the formal end of the program has been reached, and it can stop translating FORTRAN statements.

```
00100   C---------------------------------------
00200   C  NAME: TEST
00300   C  PURPOSE: TEST COMPILATION AND EXECUTION
00400   C  DESCRIPTION: DOES NO ACTUAL WORK
00500   C  NOTES: NONE
00600   C---------------------------------------
00700   C
00800   C
00900   C  . . . . . .
01000   C
01100           STOP
01200           END
```

Figure 4. A Program That Can Be Compiled and Executed

SIMPLE OUTPUT, SIMPLE VARIABLES

Before actually building useful programs, practice with getting information in and out of the compiler with the FORTRAN language is desirable. The best way to start is to improve the template file with statements which write out messages at the start and stop points during program execution. This way, the starting and ending points of the program can be visually verified. This is an established (and very simple) way of providing a small degree of verification.

This verification can be accomplished with the FORTRAN WRITE and FORMAT statements. The simplest form of the WRITE statement has the syntax:

WRITE (device-#, format-#)

The part "device-#" represents an integer which specifies a numeric code for a device on the computer. In this case, a "1" represents the console Teletypewriter (keyboard and screen). The part, "format-#" represents an integer which identifies the specific FORMAT statement containing the message to be written. The form of the FORMAT statement used will be:

format-# FORMAT (1Hb, 'message')

The part "format-#" is the same format number (integer) specified in the WRITE statement. The part "1Hb" represents the carriage control; that is, what action will be taken *before* the output device prints the message.

The "1H" tells the computer that there will be one character immediately following the "H" which will specify what carriage control will take place. The "b" represents the blank character, and in our version of FORTRAN, this means skip to the next line.

```
00100   C---------------------------------------
00200   C  NAME: MESSAGE
00300   C  PURPOSE: DISPLAY MESSAGES DEFINING PROGRAM
00400   C           START AND STOP BOUNDARIES
00500   C  DESCRIPTION: USES "WRITE" STATEMENTS TO DISPLAY
00600   C               MESSAGES UPON SCREEN
00800   C  NOTES: DEVICE CODE GOOD FOR TRS-80 ONLY
01000   C---------------------------------------
01100   C
01400   C
01500   C  . . . . . .
01600   C
01700           WRITE(1,10)
01800   10      FORMAT(1H ,'START OF PROGRAM:')
01900           WRITE(1,9999)
02000   9999    FORMAT(1H ,'END OF PROGRAM:')
02100           STOP
02200           END
```

Figure 5. A Program That Can Write Out Messages

The use of the "H" to specify a character string (of length one in this case) is only one way to specify character strings. The other way is to surround the character string by single quotes as shown in the above FORMAT statement. Since the first character of each line written with a FORMAT statement represents carriage control, the "H" (or Hollerith encoding) will be consistently used to distinguish this special character. So the template now looks like the program in Figure 5.

Since device codes can vary across different computers, it is important to note that a variable can also represent a device code. The variable is defined by specifying its type to the FORTRAN compiler using the INTEGER statement. A variable name which describes what device will receive the message is used. (I will, however, make a differentiation between input and output from the console. This allows the flexibility of changing the *output device* code so that output can go to the printer instead of the screen. Hence the use of the variable "KEY" to stand for the console *keyboard* and "TTY" (teletypewriter) to stand for the console *video screen.*)

I will try to use mnemonic variable names consistently throughout the tutorial within the limitations of six characters for a FORTRAN variable name. Once named, the value of the device is assigned to the variable using the DATA statement. This automatically assigns the value to the variable without the use of the FORTRAN assignment statement.

Use of the DATA statement should be restricted to assigning values to variables whose contents will not change throughout the execution of the program. The template now becomes the program shown in Figure 6. With a well-defined template, programs can now be written within this consistent framework.

```
00100   C---------------------------------------
00200   C  NAME: MESSAGE
00300   C  PURPOSE: DISPLAY MESSAGES DEFINING PROGRAM
00400   C           START AND STOP BOUNDARIES
00500   C  DESCRIPTION: USES "WRITE" STATEMENTS TO DISPLAY
00600   C               MESSAGES UPON SCREEN
00700   C  DEVICES: TTY - CONSOLE TELETYPEWRITER
00800   C  NOTES: CHANGE "DATA" STATEMENT FOR PARTICULAR
00900   C         COMPUTER HARDWARE
01000   C---------------------------------------
01100   C
01200           INTEGER TTY
01300           DATA TTY/1/
01400   C
01500   C  . . . . . .
01600   C
01700           WRITE(TTY,10)
01800   10      FORMAT(1H ,'START OF PROGRAM:')
01900           WRITE(TTY,9999)
02000   9999    FORMAT(1H ,'END OF PROGRAM:')
02100           STOP
02200           END
```

Figure 6. Use of Variable Device Code to Increase Program Usefulness

INPUT/OUTPUT AND ARITHMETIC OPERATIONS

Now that an adequate foundation for writing programs has been established, some working programs can be written. However, keep in mind what is meant by a "working program:"

> "Of all the requirements that we might place on a program, the first and foremost is that it be correct. In other words, it should give the correct outputs for each possible input. This is what we mean when we say that a program 'works,' and it is often said that 'any program that works is better than any program that doesn't'."[4]

Throughout this and all following tutorials, the programs shown will be copies of programs built and tested on the TRS-80. Not only should a program work, but hopefully it should be useful, too. The next three examples should show how a useful program can be written using very simple FORTRAN statements.

```
00100   C-----------------------------------------
00200   C  NAME: CHECKBOOK
00300   C  PURPOSE: PERFORM SINGLE CHECKBOOK ENTRY FUNCTION
00400   C  DESCRIPTION:
00500   C       OLD BALANCE AND DEBIT ARE ENTERED.
00600   C       NEW BALANCE CALCULATED.
00700   C       ALL VALUES ARE PRINTED.
00800   C  DEVICES:
00900   C     TTY - CONSOLE TELETYPEWRITER
01000   C     KEY - KEYBOARD
01100   C  NOTES: NONE
01200   C-----------------------------------------
01300   C
01400         REAL DEBIT,NEWBAL,OLDBAL
01500         INTEGER TTY,KEY
01600         DATA TTY/1/,KEY/1/
01700   C
01800   C  . . . . . .
01900   C
02000         WRITE(TTY,10)
02100   10    FORMAT(1H ,'START OF PROGRAM:')
02200   C
02300         WRITE(TTY,20)
02400   20    FORMAT(1H ,'OLD BALANCE:')
02500         READ(KEY,30) OLDBAL
02600   30    FORMAT(F10.2)
02700   C
02800         WRITE(TTY,40)
02900   40    FORMAT(1H ,'DEBIT:')
03000         READ(KEY,30) DEBIT
03100   C
03200         NEWBAL=OLDBAL-DEBIT
03300   C
03400         WRITE(TTY,50) OLDBAL
03500   50    FORMAT(1H ,'OLD BALANCE=',F10.2)
03600         WRITE(TTY,60) DEBIT
03700   60    FORMAT(1H ,'DEBIT=',F10.2)
03800         WRITE(TTY,70) NEWBAL
03900   70    FORMAT(1H ,'NEW BALANCE=',F10.2)
04000   C
04100         WRITE(TTY,9999)
04200   9999  FORMAT(1H ,'END OF PROGRAM:')
04300         STOP
04400         END
```

Figure 7. A Simple Checkbook Entry Calculator

The first example will utilize the READ, ASSIGNMENT, and WRITE statements to perform a simple checkbook calculation. The old balance is read in, then the debit amount is read, the new balance is then calculated, and the results are displayed, Figure 7. Notice that the assignment statement uses an equal sign to assign the calculation result to the new balance variable. FORTRAN has no keyword (like BASIC's "LET") which precedes the entire assignment statement.

Notice too how the WRITE statements are used to prompt for the appropriate input values. On today's microcomputers, most of the input is done through the keyboard. It is therefore important to keep the prompt messages clear, but also "short and sweet."

The new variables all represent dollars and cents, so the REAL statement is used to define them. By using the REAL statement, numbers can have fractional amounts (e.g., 273.274), unlike INTEGER variables which can only represent whole numbers. The FORMAT statements used to read in and write out these REAL variables use a notation to specify that 10 characters are allowed as a maximum, and that two digits must reside to the right of the decimal point (i.e., "F10.2") thus, the largest number that can be written out is "9999999.99" since the decimal point occupies a character position.

```
00100   C-----------------------------------------
00200   C  NAME: TRAVEL
00300   C  PURPOSE: CALCULATE FINAL VELOCITY AND DISTANCE
00400   C           TRAVELLED BY AN OBJECT
00500   C  DESCRIPTION:
00600   C       ACCELERATION AND TOTAL TIME ARE ENTERED.
00700   C       VELOCITY AND DISTANCE ARE CALCULATED.
00800   C       VELOCITY AND DISTANCE ARE PRINTED.
00900   C  DEVICES:
01000   C       TTY - CONSOLE TELETYPEWRITER
01100   C       KEY - KEYBOARD
01200   C  NOTES: NONE
01300   C-----------------------------------------
01400   C
01500         REAL ACCEL,DIST,TIME,VEL
01600         INTEGER TTY,KEY
01700         DATA TTY/1/,KEY/1/
01800   C
01900   C  . . . . . .
02000   C
02100         WRITE(TTY,10)
02200   10    FORMAT(1H ,'START OF PROGRAM:')
02300   C
02400         WRITE(TTY,20)
02500   20    FORMAT(1H ,'ACCELERATION (MILES/HOUR SQUARED):')
02600         READ(KEY,30) ACCEL
02700   30    FORMAT(F10.2)
02800   C
02900         WRITE(TTY,40)
03000   40    FORMAT(1H ,'TOTAL TIME (HOURS):')
03100         READ(KEY,30) TIME
03200   C
03300         VEL = ACCEL * TIME
03400         DIST = (ACCEL*(TIME**2))/2.0
03500   C
03600         WRITE(TTY,50) VEL
03700   50    FORMAT(1H ,'VELOCITY=',F15.2,' MILES/HOUR')
03800         WRITE(TTY,60) DIST
03900   60    FORMAT(1H ,'DISTANCE=',F15.2,' MILES')
04000   C
04100         WRITE(TTY,9999)
04200   9999  FORMAT(1H ,'END OF PROGRAM:')
04300         STOP
04400         END
```

Figure 8. Calculating Distance and Velocity

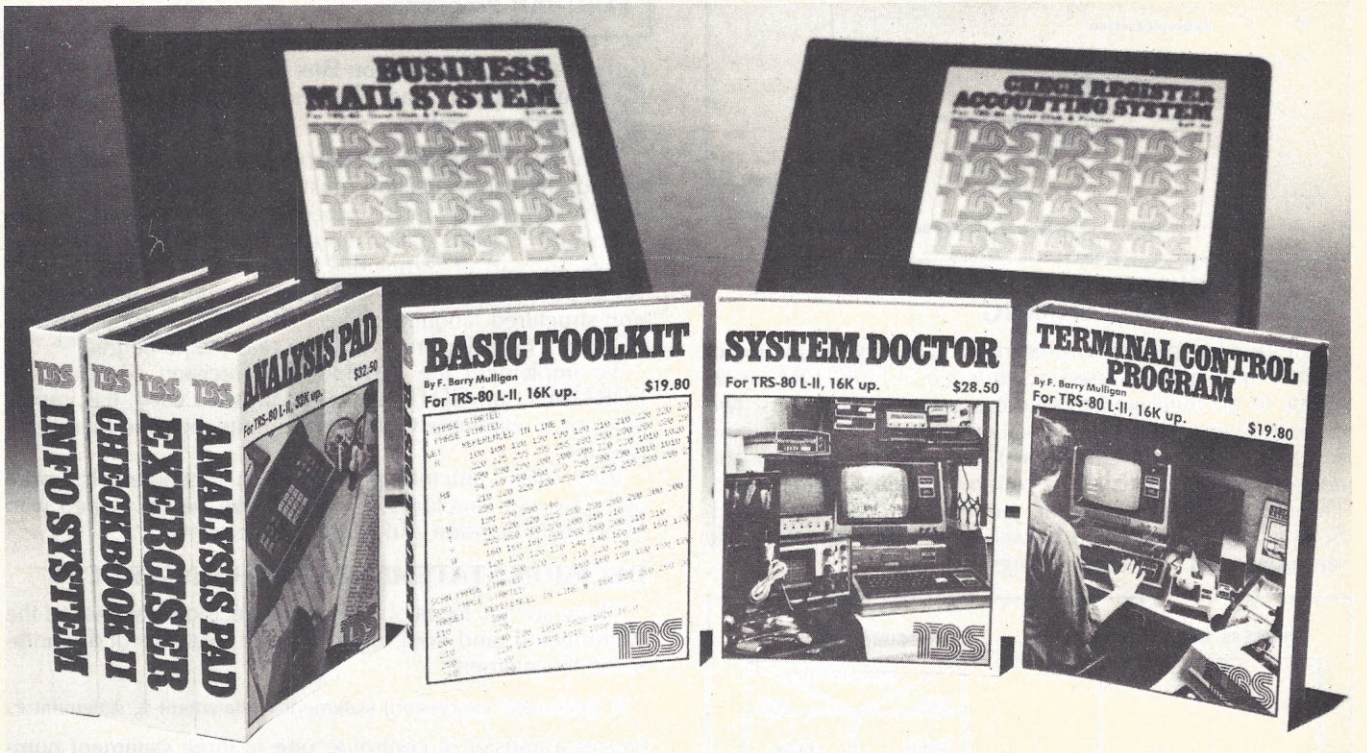
The second example shows the use of the multiplication ("*"), division ("/"), and exponentiation ("**") operators, as they solve some standard physics equations, Figure 8. In this problem, an object is traveling with a constant acceleration for a given period of time. Its final velocity is simply the result of the acceleration multiplied by the time. The total distance traveled in that time is one-half the product of the acceleration and the square of the time. Notice that the division is done by "2.0" and not by "2." This is done to keep the *mode* (in this case, REAL) of the expression as constant as possible. This is in keeping with safe programming practices.

The only exception should be exponentiation of any expression by an integer constant or variable. Results are always accurate when this occurs because FORTRAN compilers can translate exponentiation by whole numbers easily into machine language. Also, exponentiation by REAL constants or variables is usually done by a complex algorithm at program execution time.

Since execution speed is usually an important factor when programming microcomputers, none should be wasted extravagantly. The effects of this type of inefficiency are noticed when a *frequently* executed segment of code contains exponentiation by a real number.

As for the remaining undiscussed symbols in the program, parentheses are used around arithmetic expressions to spe-

THE BEST.



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cify an order of evaluation. In the case of the velocity equation, the exponentiation is done first, then the multiplication, and finally the division. Thus, order of evaluation is from innermost set to outermost set of parentheses. There is an implied order of operations, however, which holds at all times, and is summarized in Table 1.

Table 1. FORTRAN Relational Operators

		highest level (done first)
( )	parentheses	
**	exponentiation	
* /	multiplication and division have same level of precedence	
+ -	addition and subtraction have same level of precedence	
		lowest level (done last)

NOTE: order of evaluation is always left to right.

A STEP TOWARDS STRUCTURED FORTRAN PROGRAMMING

The first few programs presented have very simple logic. That is, all programs used a *sequence* of FORTRAN statements to do their work. For more complex problems, two other fundamental control structures (i.e., a way of executing a set of FORTRAN statements) are needed: *iteration* and *decision*. In fact, that's all the control structures really needed. Throughout the rest of the tutorial, we will use Nassi-Schneiderman Structured Flowcharts (NSSF) to graphically represent these control structures.

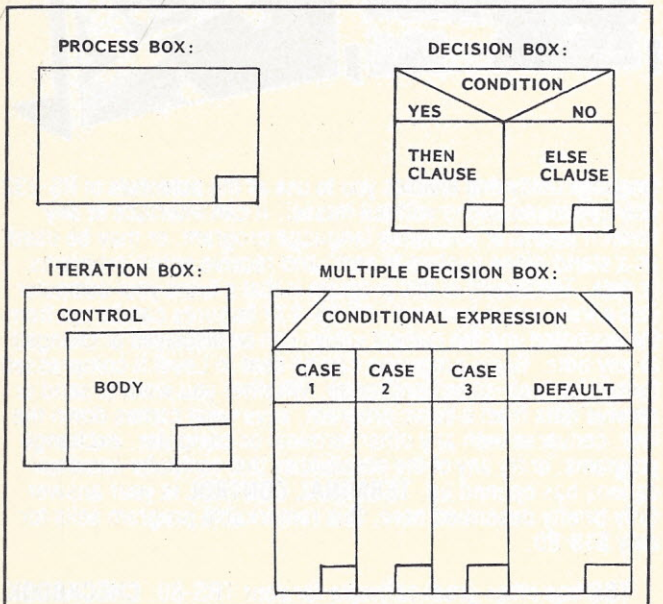


Figure 9. Modified Massi-Schneiderman Structured Flowchart Constructs

The basic components of the language are the: PROCESS BOX, ITERATION BOX, and DECISION BOX. Also included for our purposes is the MULTIPLE DECISION BOX which will simplify the representation of more complex sets of decisions in a program, Figure 9. The little square in the lower right-hand corner of Process Boxes is reserved for a box identification number. For example, using just a sequence of Process Boxes, we can produce a general representation of the first three programs presented in this article, Figure 10. The Decision Boxes allow only one particular Process Box to execute based on the status of some specified condition. The Iteration Box allows a particular Process Box to execute a number of times depending on the status of some specified control.

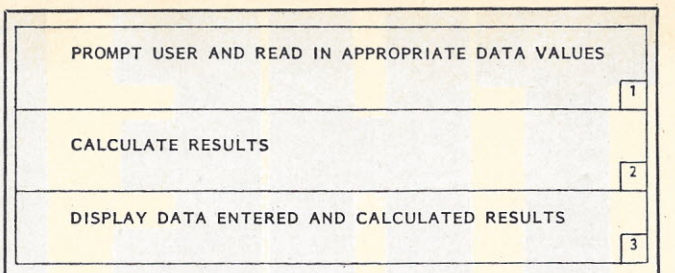


Figure 10. General Representation of Our Simple FORTRAN Programs

Now that FORTRAN programs can be graphically represented, this representation must be turned into actual FORTRAN statements. These processes of representing a program and translating the representation in language statements are part of Structured Programming. While controversy does exist about producing structured programs in non-structured languages like FORTRAN, most agree that FORTRAN can be structured to a reasonable degree.[5,6]

To implement the Iteration and Decision constructs in FORTRAN, the GOTO statement must be used. It is important not to eliminate GOTO statements, but use them very carefully.

With these structure programming fundamentals, more complex, yet structured, programs can be developed with FORTRAN decision and iteration statements.

DECISION STATEMENTS AND CONSTRUCTS

There are two types of FORTRAN decision statements: the Arithmetic IF and the Logical IF. The structure of the arithmetic IF statement:

"IF (arithmetic expression) statement-#, statement-#, statement-#

causes a transfer of control to one of three statement numbers depending upon the result (positive, zero, or negative respectfully) of the "arithmetic expression." Many programming problems can occur when using the arithmetic IF statement, so this tutorial will not further investigate its use.

The structure of the logical IF statement:

IF (logical expression) statement

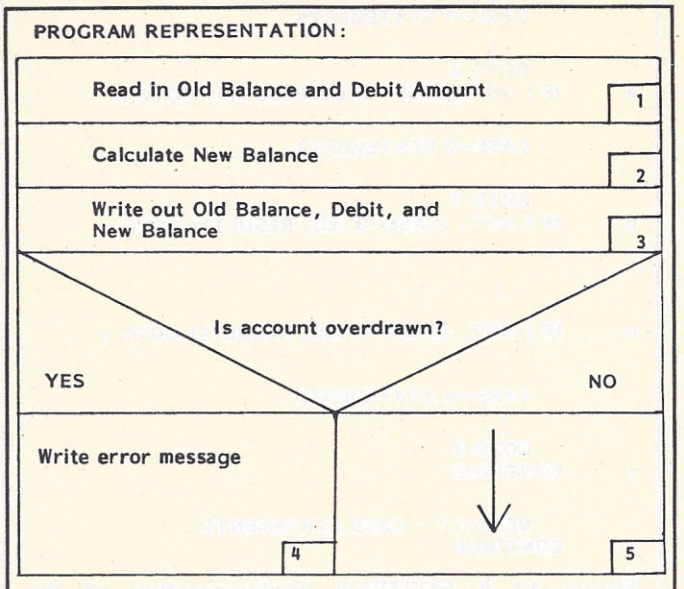
was added to the language as a clearer way of expressing conditionals. The "logical expression" is evaluated and if the result is "TRUE," the statement immediately following the closing parenthesis is executed. The types of operators allowed in the "logical expression" are relational operators (see Table 2) as well as the arithmetic operators. Any FORTRAN variable or constant is also allowed. However, the result of the expression *must* be either "TRUE" or "FALSE."

Table 2. Order of FORTRAN Operations

OPERATOR	MEANING
.AND.	"AND" operation
.OR.	"OR" operation
.NOT.	"NOT" operation
.LT.	less than
.LE.	less than or equal to
.GT.	greater than
.GE.	greater than or equal to
.EQ.	equal to
.NE.	not equal to

It is the logical IF statement that will be used to create structured programming DECISION constructs. The simplest use of the logical IF statement occurs when only one FORTRAN

statement is executed according to some condition (the classical IF-THEN). This is shown in Figure 11, where an additional function of withdrawn account message has been added to the checkbook program.




```
00100   C-----------------------------------------
00200   C  NAME: CHECKBOOK
00300   C  PURPOSE: PERFORM SINGLE CHECKBOOK ENTRY FUNCTION
00400   C  DESCRIPTION:
00500   C       OLD BALANCE AND DEBIT ARE ENTERED.
00600   C       NEW BALANCE CALCULATED.
00700   C       ALL VALUES ARE PRINTED.
00800   C  DEVICES:
00900   C     TTY - CONSOLE TELETYPEWRITER
01000   C     KEY - KEYBOARD
01100   C  NOTES: NONE
01200   C-----------------------------------------
01300   C
01400           REAL DEBIT,NEWBAL,OLDBAL
01500           INTEGER TTY,KEY
01600           DATA TTY/1/,KEY/1/
01700   C
01800   C . . . . . .
01900   C
02000           WRITE(TTY,10)
02100    10     FORMAT(1H ,'START OF PROGRAM:')
02200   C
02300           WRITE(TTY,20)
02400    20     FORMAT(1H ,'OLD BALANCE:')
02500           READ(KEY,30) OLDBAL
02600    30     FORMAT(F10.2)
02700   C
02800           WRITE(TTY,40)
02900    40     FORMAT(1H ,'DEBIT:')
03000           READ(KEY,30) DEBIT
03100   C
03200           NEWBAL=OLDBAL-DEBIT
03300   C
03400           WRITE(TTY,50) OLDBAL
03500    50     FORMAT(1H ,'OLD BALANCE=',F10.2)
03600           WRITE(TTY,60) DEBIT
03700    60     FORMAT(1H ,'DEBIT=',F10.2)
03800           WRITE(TTY,70) NEWBAL
03900    70     FORMAT(1H ,'NEW BALANCE=',F10.2)
04000           IF(NEWBAL .LT. 0.00) WRITE(TTY,80)
04100    80     FORMAT(1H ,'** ACCOUNT OVERDRAWN **')
04200   C
04300           WRITE(TTY,9999)
04400   9999    FORMAT(1H ,'END OF PROGRAM:')
04500           STOP
04600           END
```

Figure 11. Checkbook Entry Calculator with Withdrawn Account Message

The next level of sophistication is reached when the full IF-THEN-ELSE construct is implemented (Figure 12). The entire "condition" is negated within the parentheses, appropriately causing a jump to the FORTRAN statements represent-

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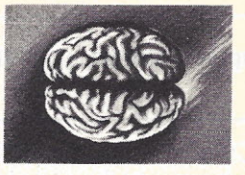

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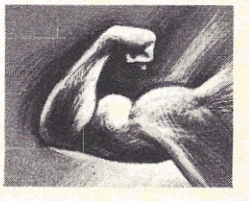

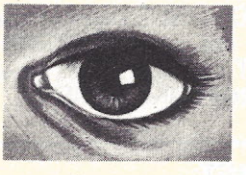

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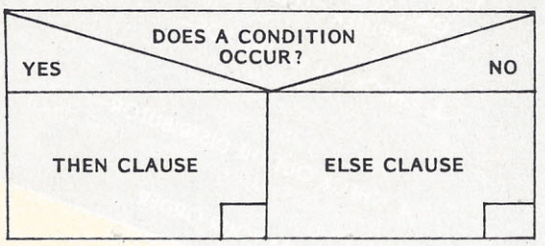
ELSE clause when the condition is "FALSE." If the "condition" holds, the entire expression within the parentheses is FALSE, and the FORTRAN statements representing the THEN clauses are executed.

A GOTO at the end of these statements forces the program's flow of control to the last statement of the construct. So no matter what the result of the "condition," the flow of control always ends up at statement "n".

IF-THEN-ELSE CONSTRUCT REPRESENTATION:



PROGRAM STATEMENTS:

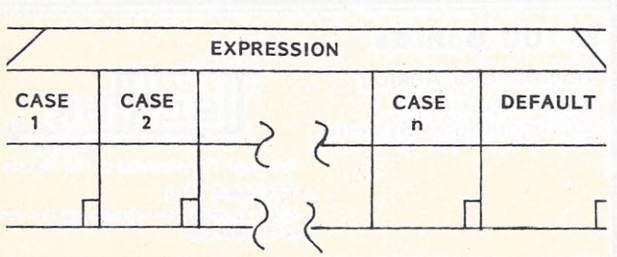
```
        IF (.NOT.(condition)) GOTO m
                .
                .
          then clause
                .
                .
          GOTO n
m       CONTINUE
                .
                .
          else clause
                .
                .
n       CONTINUE
```

Figure 12. A FORTRAN Implementation of IF-THEN-ELSE Construct

Notice that the FORTRAN CONTINUE statement is used to define the start of the ELSE clause, and the end of the entire construct. Since the CONTINUE statement in FORTRAN does no real work, it serves as a very useful mechanism to define boundary points in the IF-THEN-ELSE construct.

The MULTIPLE DECISION construct (Figure 13) is implemented in exactly the same way the IF-THEN-ELSE construct was implemented. The set of FORTRAN statements which are executed for a particular condition appear immediately after the corresponding IF statement containing the appropriate condition. The last statement in each set of statements has a GOTO to a CONTINUE statement defining the end of the construct. The last set of FORTRAN statements represent the DEFAULT case (i.e., what actions are performed if none of the conditions are "TRUE").

MULTIPLE DECISION CONSTRUCT:



PROGRAM STATEMENTS:

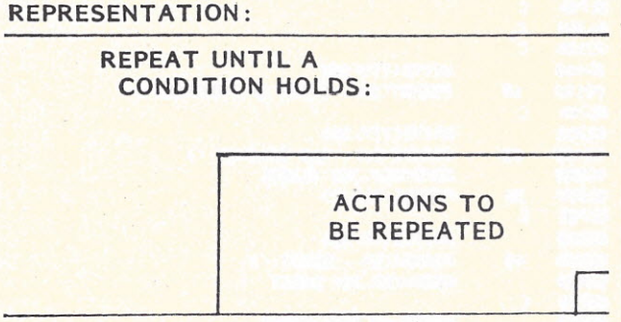
```
        RESULT = EXPRESSION
        IF (.NOT.(CASE—1 .EQ. RESULT)) GOTO a
                :
          CASE—1 STATEMENTS
                :
          GOTO Z
a       IF (.NOT.(CASE—2 .EQ.RESULT)) GOTO b
                :
          CASE—2 STATEMENTS
                :
          GOTO Z
b       IF (.NOT. (CASE—3 .EQ. RESULT)) GOTO c
                :
                :
                :
n       IF (.NOT. (CASE—n .EQ. RESULT)) GOTO y
                :
          CASE—n STATEMENTS
                :
          GOTO Z
y       CONTINUE
                :
          DEFAULT - CASE STATEMENTS
z       CONTINUE
```

Figure 13. A FORTRAN Implementation of the MULTIPLE DECISION Construct

ITERATION STATEMENTS AND CONSTRUCTS

We have taken a look at SEQUENCE and DECISION structured programming constructs, as well as FORTRAN implementations of each. A look at the last type of control flow, ITERATION, will finish this first investigation of the FORTRAN language. ITERATION is probably the most interesting type of control flow because it is the real source of

REPRESENTATION:



PROGRAM STATEMENTS:

```
m       IF (condition) GOTO n
                .
                .
          statements to be repeated
                .
                .
          GOTO m
n       CONTINUE
```

Figure 14. The ITERATION Construct

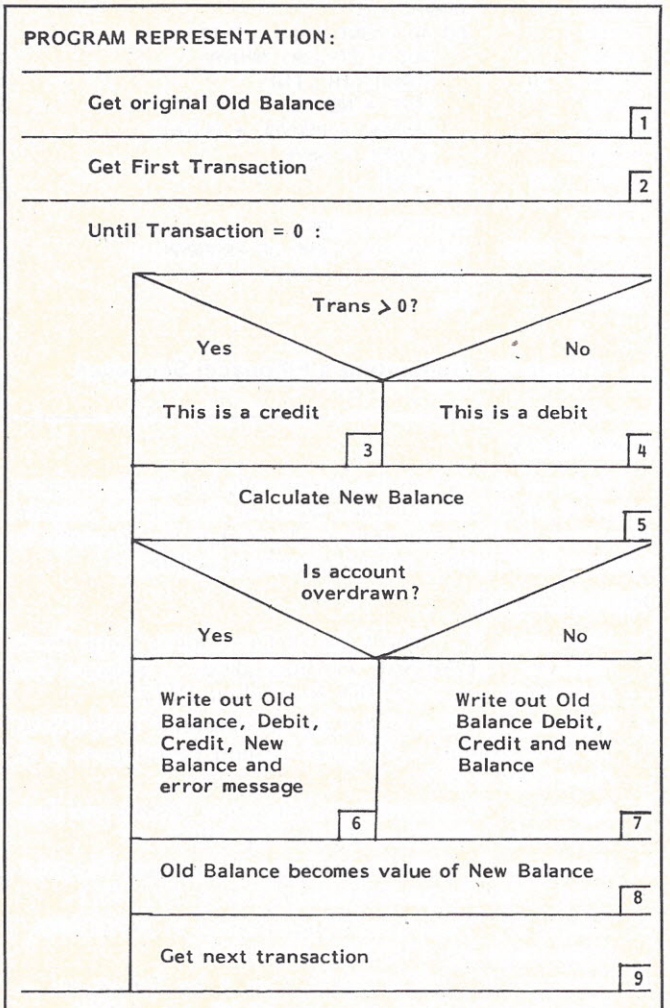
the computer's power. It has, however, also been the source for a great many errors.

The ITERATION construct must be used wisely and appropriately when programming. Also, any FORTRAN implementation of the construct must be simple to write and read for the programmer, so that the deadly endless loop can be avoided whenever possible.

The basic ITERATION construct is shown in Figure 14, with its FORTRAN equivalent. This, in fact, is the only form of ITERATION that is needed, although other forms are sometimes used. The logical IF statement is used to test the "condition" and jump to the CONTINUE statement (loop boundary) when the "condition" is "TRUE." The statements within the body of the loop are continuously repeated due to the GOTO statement branching back to the "condition" test point. Since the test is always done at the beginning of the loop, the statements comprising the loop body may be executed zero to many times.

When using the ITERATION construct during programming, one must always be careful to do two things:

1. properly set up the initial condition before entering the loop, and
2. ensure that the statement which will eventually cause the loop to terminate is the *last* statement in the loop body.



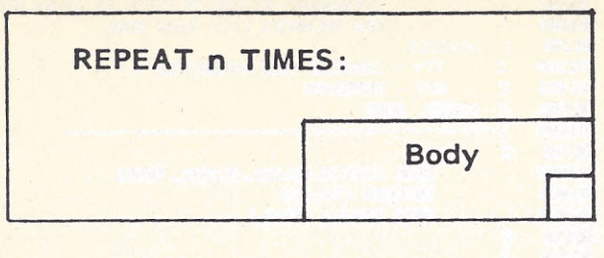

```
00100   C-----------------------------------------
00200   C  NAME: CHECKBOOK
00300   C  PURPOSE: PERFORM MULTIPLE CHECKBOOK ENTRY FUNCTIONS
00400   C  DESCRIPTION:
00500   C       ORIGINAL BALANCE IS ENTERED.
00600   C       THE FOLLOWING IS THEN REPEATED:
00700   C           A TRANSACTION IS ENTERED.
00800   C           NEW BALANCE CALCULATED.
00900   C           ALL VALUES ARE PRINTED.
01000   C           OVERDRAWN ACCOUNT MESSAGE IS GIVEN FOR
01100   C           NEW BALANCES LESS THAN ZERO.
01200   C  DEVICES:
01300   C      TTY - CONSOLE TELETYPEWRITER
01400   C      KEY - KEYBOARD
01500   C  NOTES: NONE
01600   C-----------------------------------------
01700   C
01800         REAL CREDIT,NEWBAL,OLDBAL,TRANS
01900         INTEGER TTY,KEY
02000         DATA TTY/1/,KEY/1/
02100   C
02200   C  . . . . . .
02300   C
02400         WRITE(TTY,10)
02500   10    FORMAT(1H ,'START OF PROGRAM:')
02600   C
02700         WRITE(TTY,20)
02800   20    FORMAT(1H ,'ORIGINAL BALANCE:')
02900         READ(KEY,30) OLDBAL
03000   30    FORMAT(F10.2)
03100   C
03200         WRITE(TTY,40)
03300   40    FORMAT(1H ,'TRANSACTION:')
03400         READ(KEY,30) TRANS
03500   C
03600   41    IF (TRANS .EQ. 0.00) GO TO 200
03700            IF (.NOT.(TRANS .GT. 0.00)) GO TO 42
03800               CREDIT = TRANS
03900               DEBIT = 0.00
04000               GO TO 44
04100   42       CONTINUE
04200               CREDIT = 0.00
04300               DEBIT = -TRANS
04400   44       CONTINUE
04500            NEWBAL=OLDBAL+CREDIT-DEBIT
04600            IF (.NOT.(NEWBAL .GE. 0.00)) GOTO 80
04700               WRITE(TTY,50) OLDBAL
04800   50          FORMAT(1H ,'OLD BALANCE=',F10.2)
04900               WRITE(TTY,60) DEBIT
05000   60          FORMAT(1H ,'DEBIT=',F10.2)
05100               WRITE(TTY,65) CREDIT
05200   65          FORMAT(1H ,'CREDIT=',F10.2)
05300               WRITE(TTY,70) NEWBAL
05400   70          FORMAT(1H ,'NEW BALANCE=',F10.2)
05500               GO TO 100
05600   80       CONTINUE
05700               WRITE(TTY,50) OLDBAL
05800               WRITE(TTY,60) DEBIT
05900               WRITE(TTY,65) CREDIT
06000               WRITE(TTY,70) NEWBAL
06100               WRITE(TTY,90)
06200   90          FORMAT(1H ,'** ACCOUNT OVERDRAWN **')
06300   100      CONTINUE
06400            OLDBAL = NEWBAL
06500            WRITE(TTY,40)
06600            READ(KEY,30) TRANS
06700            GO TO 41
06800   200   CONTINUE
06900   C
07000         WRITE(TTY,9999)
07100   9999   FORMAT(1H ,'END OF PROGRAM:')
07200         STOP
07300         END
```

Figure 15. Continuous Entry of Transactions into Checkbook

This concept is exemplified by an enhancement to the checkbook program, Figure 15, which allows the user to enter transactions until a zero entry terminates the session. Notice that a READ transaction statement immediately preceeds the loop control (IF) and is also the last statement in the loop body. This is sometimes called "READ-FIRST logic" because a read always occurs immediately before the next test of the loop control.

While the logical IF statement was used to implement the ITERATION construct for loops with no explicit limit to the number of repetitions, FORTRAN does have a statement which will create a loop capable of iterating a specific number of times:

DO statement-# variable$_1$ = variable$_2$, variable$_3$, variable$_4$



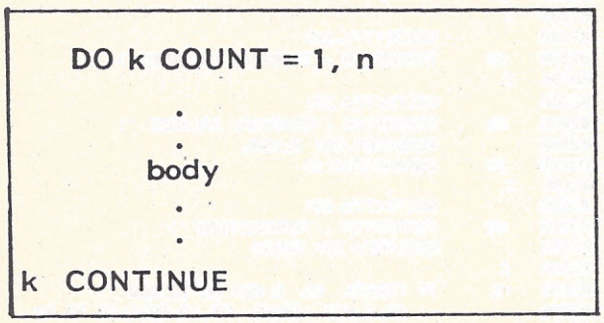
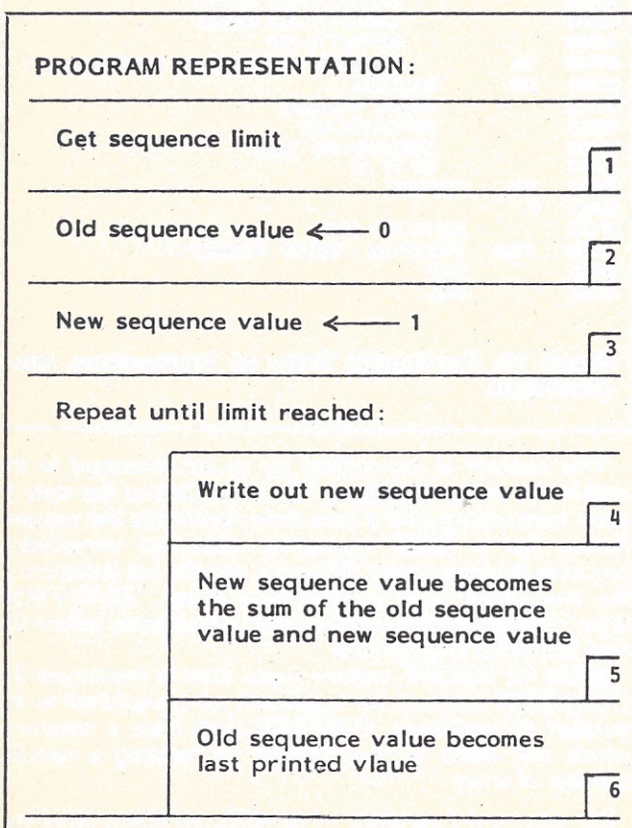


Figure 16. DO Statement Implementation of ITERATION Construct

where: 1) "statement-#" is a FORTRAN statement number defining the end of the loop, 2) "variable$_1$" is the special variable which takes on the value of each iteration as specified by the other three variables, 3) "variable$_2$" specifies the beginning value of the loop, 4) "variable$_3$" specifies the terminating value of the loop, and 5) "variable$_4$" (which is optional) specifies the increment step size.

An implementation of a structured ITERATION construct is shown in Figure 16, and a classical example of its use (generating the Fibonacci Sequence) is given in Figure 17. Our old friend the CONTINUE statement is used to mark the loop's boundary point.




```
00100   C---------------------------------------
00200   C  NAME: FIBONACCI
00300   C  PURPOSE: PRODUCE FIBONACCI SEQUENCE
00400   C  DESCRIPTION:
00500   C        SEQUENCE LIMIT READ IN.
00600   C        UNTIL THE LIMIT IS REACHED:
00700   C           THE NEW SEQUENCE VALUE IS CALCULATED
00800   C           THE NEW SEQUENCE VALUE IS PRINTED.
00900   C  DEVICES:
01000   C        TTY - CONSOLE TELETYPEWRITER
01100   C        KEY - KEYBOARD
01200   C  NOTES: DOES CHECK FOR INVALID SEQUENCE LIMIT
01300   C---------------------------------------
01400   C
01500           INTEGER COUNT,LIMIT,NEWVAL,OLDVAL,SAVE
01600           INTEGER TTY,KEY
01700           DATA TTY/1/,KEY/1/
01800   C
01900   C  . . . . . .
02000   C
02100           WRITE(TTY,10)
02200    10     FORMAT(1H ,'START OF PROGRAM:')
02300   C
02400           WRITE(TTY,20)
02500    20     FORMAT(1H ,'SEQUENCE LIMIT:')
02600           READ(KEY,25) LIMIT
02700    25     FORMAT(I2)
02800   C
02900           OLDVAL = 0
03000           NEWVAL = 1
03100           DO 40 COUNT = 1 , LIMIT
03200              WRITE(TTY,30) NEWVAL
03300    30        FORMAT(1H ,I10)
03400              SAVE = NEWVAL
03500              NEWVAL = NEWVAL + OLDVAL
03600              OLDVAL = SAVE
03700    40     CONTINUE
03800   C
03900           WRITE(TTY,9999)
04000    9999   FORMAT(1H ,'END OF PROGRAM:')
04100           STOP
04200           END
```

Figure 17. Generating a Fibonacci Sequence

SUMMARY

I hope all of you had the opportunity to actually program some or all of the examples given in this tutorial chapter. Next time, I will be adding more structure to the programs by utilizing FORTRAN's subprogramming facilities.□

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The author thanks Softech, Inc., Medicomp Systems, Inc. and Microsoft, Inc. for their help in the preparation of this series. *David A. Marca can be contacted at P.O. Box 1234, Cerritos, CA 90701.*

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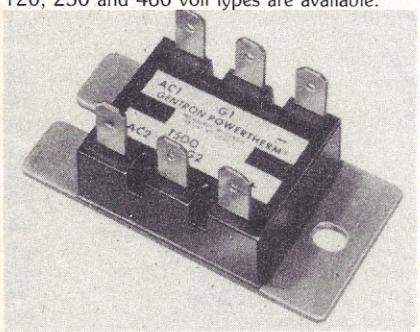

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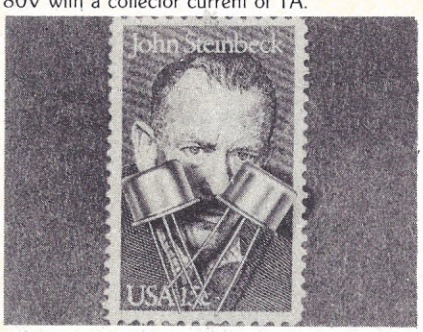
The 2N4404 and 2N4405 are silicon general-purpose and switching PNP transistors with collector-emitter and collector-base voltages of 80V with a collector current of 1A.



The transistors have 25nA collector and emitter cut-off currents. Rise time is 25nsec and fall time is 35nsec. Minimum current-gain-band-width product is 200MHz with a maximum of 600Mhz.

For details contact Solid State Devices Inc., 14830 Valley View Ave., La Mirada, CA 90638.

CIRCLE INQUIRY NO. 123

Super Sockets

Integrated Electronic Products has expanded its line of Super Sockets to include a full range of low profile sockets in sizes from 8 to 40 pins.

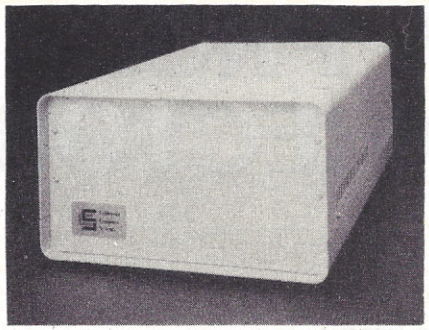
These devices feature a higher package density at a very affordable price and are available in pin solder and wire wrap.

Available at electronic stores. For details contact IEP, P.O. Box 2022, Orange, CA 92669.

CIRCLE INQUIRY NO. 128

S-100 Mainframe

California Computer Systems has a 12-slot, actively-terminated S-100 mainframe designed to give system builders a powerful tool in a small package.



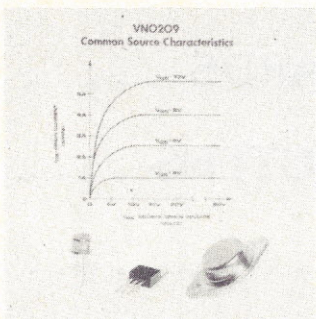
The S-100 mainframe, measuring 11⅝" high, 7" wide and 18" deep, comes complete with a fan and a circuit breaker. It supports output voltages of +8VDC at 20 amps and ± 16VDC at 4 amps. Input may be 105, 115 or 125 VAC.

For details contact California Computer Systems, 309 Laurelwood Dr., Santa Clara, CA 95050.

CIRCLE INQUIRY NO. 124

Power Transistors

The addition of a family of VMOS power transistors by Supertex, Inc., includes both N-channel devices, the VN02s, and P-channel devices, the VP02s.



Both are manufactured with the Supertex proprietary silicon gate process, for superior performance and proven reliability. The VN02s are available in voltage ranges of 40-90, 100-150 and 160-220 volts. The VP02s are available with breakdown voltages between 40 and 90 volts.

For details contact Supertex, Inc., 1225 Bordeaux Dr., Sunnyvale, CA 94086.

CIRCLE INQUIRY NO. 125

Momentary Pushbutton

The Alcoswitch MSPF Series Momentary Pushbuttons feature a large button and a fully threaded 15/32" body which allows a choice of front or real panel mounting.

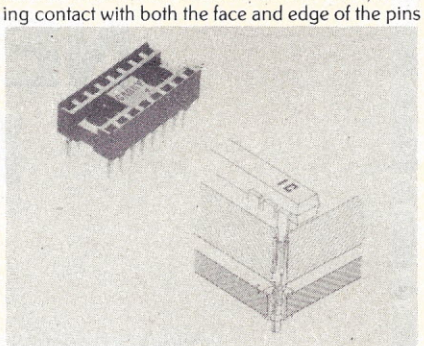
Available as either normally open, normally closed or N.O.-N.C. All models have epoxy seals on terminals to eliminate contamination during the soldering procedure.

For details contact Alco Electronic Products, Inc., 1551 Osgood St., N. Andover, MA 01845.

CIRCLE INQUIRY NO. 126

IC Sockets

Series QS520/QS530 are low-cost wire-wrappable IC sockets with four-tine Quad-Spring (patent pending) contacts. The Quad-Spring contacts surround the IC lead on all four sides, making contact with both the face and edge of the pins



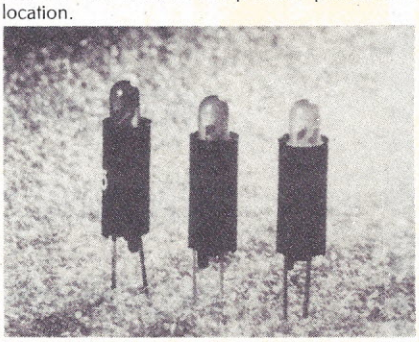
at the same time, giving the advantages of both face-wipe and edge-wipe contacts. Available in closed-entry model with either thermoplastic or high-temperature dially phthalate FS-10 material.

For details contact Garry Mfg. Co., 1010 Jersey Ave., New Brunswick, NJ 08902.

CIRCLE INQUIRY NO. 127

Circuit Board LED Indicators

The IDI 5310 Series is a subminiature Super-Brite LED indicator-light assembly intended for circuit board mounting. The indicator presses into holes in the PC board and provides precise LED location.



The indicator incorporates ultra-high intensity light output LEDs utilizing state-of-the-art construction. Red, green and yellow colors are available. The high-dome lens permits maximum light output over a 90-degree viewing angle.

For details contact Industrial Devices, Inc., 7 Hudson Ave., Edgewater, NJ 07020.

CIRCLE INQUIRY NO. 130

Stepper Motor Controller

The CY500 Stored Programm Stepper Motor Controller is an N-MOS device that is user programmable, executing 22 separate function oriented commands, specified using single letters such as 'P' for position, 'S' for slope, and 'R' for rate.

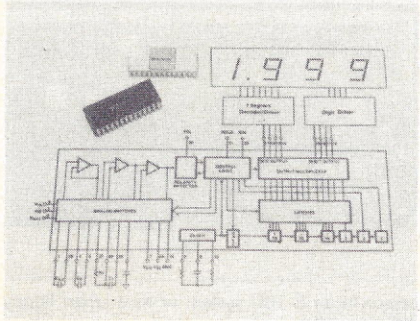
A key feature of the CY500 is its ability to either execute commands at once in the command mode, or store a sequence of commands as a program and then run the program.

For more information contact Cybernetic Micro Systems, 445-203 So. San Antonio Rd., Los Altos, CA 94022, (415) 949-0666.

CIRCLE INQUIRY NO. 310

3½-Digit A/D Converter

The 8751 converter with multiplexed BCD data outputs and four digit outputs, is perfect where high power LEDs and Gas Discharge displays are used and where microprocessor or printing interfacing is required.



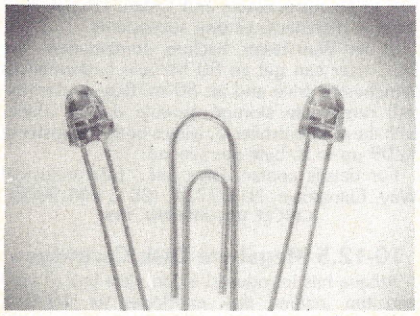
The chip contains a dual-slope A/D converter and all digital circuitry necessary to provide a multiplexed BCD output.

Prices start at $4.80. For more information contact Teledyne Semiconductor, 1300 Terra Bella Ave., Mountain View, CA 94043.

CIRCLE INQUIRY NO. 311

Miniature LED

The X-90B series are T-1-¾ short-lens LEDs featuring 5.33 mm-long encapsulations for instrument control panels and other applications where a low-profile, high-output solid state lamp is desired.



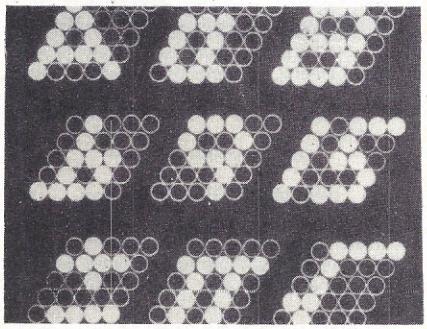
These subminiature LEDs are designed for high-efficiency, low-current operation with integrated circuitry. The short-lens series offers light-color outputs of red, green, yellow and orange.

For more information contact Chicago Miniature Lamp Works, 4433 N. Ravenswood Ave., Chicago, IL 60640.

CIRCLE INQUIRY NO. 312

Alpha-Numeric Display System

The Laitram Alpha-Numeric Display System is capable of forming numbers and alphabet letters at a much lower cost in components and circuitry than typical 35 dot displays.



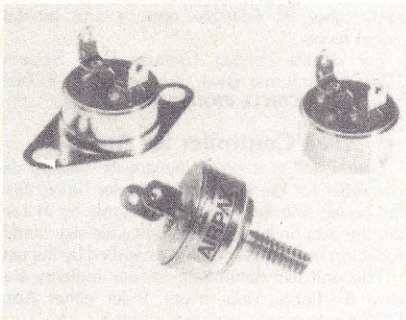
Nested arrays of 23 dots or less, tilted at a 60° angle, can form all upper and lower case alphabet letters, numerals from 0 through 9 and most mathematic and scientific symbols.

For details contact the Laitram Licensing Dept., P.O. Box 50699, New Orleans, LA 70150, (504) 733-6000.

CIRCLE INQUIRY NO. 313

Isolated Contact Thermostat

The Airpax Series 5200 Thermostat was designed for military and heave industrial applications requiring an hermetically sealed thermostat. This single pole isolated contact thermostat provides both dependable and accurate sensing and switching in one compact device.



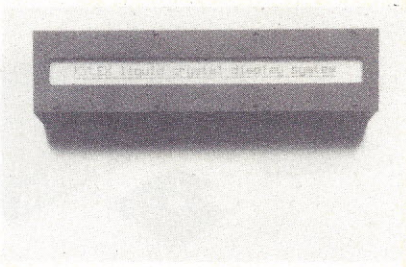
Its laser-welder construction is designed to withstand severe vibration and shock and meets stringent Mil spec requirements.

For details contact Airpax/North American Phillips Controls Corp., P.O. Box 500, Frederick, MD 21701.

CIRCLE INQUIRY NO. 314

Liquid Crystal Display System

Kylex, Inc. has a one-line, 40-character 5x10 dot matrix liquid crystal (LC) display system with integral electronics. The LX140 can interface directly with microprocessors through a single peripheral parallel interface device.



The LX140 flat display panel is a low-power, low-voltage system with integral drive, refresh, temperature compensation and power supply electronics.

For more information contact Kylex, Inc., 420 Bernardo Ave., Mountain View, CA 94043.

CIRCLE INQUIRY NO. 315

Infrared Detection Diode

Ferranti Electric, Inc. has a high speed infrared detection photo-diode with a highly selective spectral response and a built-in transmissive filter. The Ferranti BPW41 Silicon P.I.N. Infra-Red Detection Photo-Diode has a narrow band transmissive filter incorporated in the encapsulation medium which results in a very selective response curve, making it ideal for IR detection.

For details contact Ferranti Electric, Inc., Semiconductor Products, 87 Modular Ave., Commack, NY 11725, (516) 543-0200.

CIRCLE INQUIRY NO. 321

Linear Buffer/Voltage Follower

The BUF-03 is a high-speed monolithic buffer/voltage follower. The open-loop circuit design of the device permits both high speed and accurate dc operation at an attractive price.

The BUF-03 has a 300/V μsec typical slew rate and a 63 mHz bandwidth. The dc input offset voltage specification is 6mV maximum and 2mV typical. The 150 pA input bias current will keep source impedance errors at a minimum. Gain is 0.997 V/V with excellent 0.015% nonlinearity over the full input voltage range.

For details contact Precision Monolithics Inc., 1500 Space Park Dr., Santa Clara, CA 95050.

CIRCLE INQUIRY NO. 316

Analog Multiplexers

The HI-516 is a sixteen-channel multiplexer which can be used in either a single-ended or differential mode. The HI-518 is an eight-channel multiplexer which is also single-ended/differential selectable.

The HI-516 and HI-518 have typical access times of 90 ns and typical settling times of 800 ns to 0.01%.

These products are ideal for use in high speed data acquisition systems such as those found in avionics and industrial process control. The HI-516 is available in a 28-pin ceramic DIP and the HI-518 is in an 18-pin ceramic DIP.

For more information contact Harris Semiconductor Group, P.O. Box 883, Melbourne, FL 32901, (305) 724-7407, Gregory Steele.

CIRCLE INQUIRY NO. 317

Multi-Line Display Module

The M2400 Random Access Multi-Line Display Module features vacuum fluorescent display technology of 2 lines of 40 character columns, 0.2 inch (5mm) character height, 5x7 dot matrix with additional underline position for each character.

The M2400 includes all drive, refresh, power conversion and interface circuitry in a compact two PC board sandwich configuration of less than 1.75 inches thickness. Data transfers can be accomplished in less than 10 microseconds per character on a continuous basis with no effect on the refresh cycle.

Price is $520 in 100s. For details contact Digital Electronics Corp., 197 Airport Blvd., Burlingame, CA 94010.

CIRCLE INQUIRY NO. 318

Military Version D/A Converter

The military version of a series of 8-bit monolithic multiplying digital-to-analog converters that feature a power consumption of just 33 milliwatts is available from Signetics.

Designated the Dac-08 military standard 883 series, the converters profive direct interface to all popular logic families. Full noise immunity is provided by the high swing, adjustable threshold logic inputs.

Power supply range is from 4.5 volts to 18 volts with essentially unchanged performance over the range.

For details contact Signetics Corp., P.O. Box 9052, Sunnyvale, CA 94086.

CIRCLE INQUIRY NO. 319

VMOS FETs with 2.5 Resistance

A second family of VMOS FETs from Intersil is rated at 2.5Ω ON resistance and is available in ultra-small TO-52 and TO-237 packages. The devices employ a flat-bottom V-groove for additional stability and have breakdown voltages of 40, 60 and 80 volts.

Design features include high-speed switching at 0.7 to 2.4 A continuous drain current and 2.0 to 3.0 A peak drain current. The devices have inherent current-sharing capability when paralleled, and directly interface to CMOS, TTL or DTL logic. DC biasing is simple, and the IVN5000 family has extended safe operating areas.

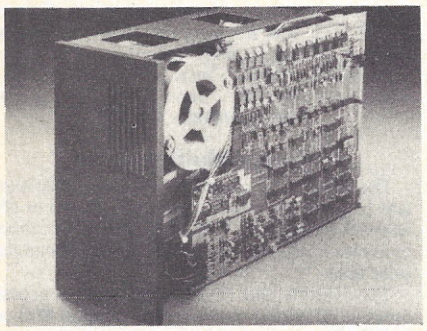
For details contact Intersil, Inc., 10710 N. Tantau Ave., Cupertino, CA 95014.

CIRCLE INQUIRY NO. 320

DISKS

8-Inch Fixed Disk Drive

The SA1000 Series of 8" fixed disk drives offers Winchester fixed disk technology in a floppy size package. The drives are available in 5 and 10 megabyte versions.



In addition to providing the same physical dimensions and mounting holes as an 8" floppy, the SA1000 features a simple interface using a command structure similar to a floppy drive.

For details contact Shugart, 435 Oakmead Pkwy., Sunnyvale, CA 94086.

CIRCLE INQUIRY NO. 131

Double-Storage Diskette System

Burroughs Corporation has introduced a double-storage diskette system in its Redactor II series of display word processors. The model, called the Burroughs R II System 250, uses dual-sided, double-density diskettes for information storage, thus doubling the number of documents or diskette filing space available to the word processing operator at any one time.

On a dual diskette system, this means 286,000 characters per diskette or approximately 140 pages. The Burroughs System 250 is also available with triple diskette transports. Burroughs also announced price reductions on all diskette models in the Burroughs R II series of display word processors.

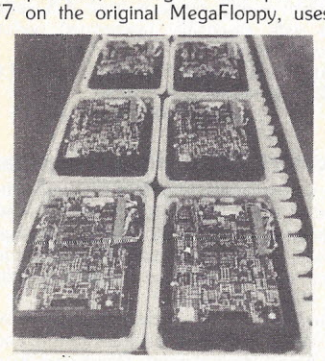
Burroughs R II display word processors are powerful stand-alone text editors. A full-page display shows formats and notations exactly as they will appear on the final printed page. A magnetic keyboard provides tactile feedback to the system operator, reducing input errors.

For more information contact Burroughs Word Processing, 95 Horse Block Rd., Yaphank, NY 11980, (516) 924-0700.

CIRCLE INQUIRY NO. 322

New Micropolis Drives

Micropolis Corporation has added four new 96 tracks-per-inch products to its current line of 100 tpi single-sided and double-sided floppies. The new 96 tpi drives, offering 70 tracks per side versus 77 on the original MegaFloppy, uses the



same mechanical device features that have made the company's drives widely regarded for their reliability.

For more information contact Micropolis Corp., 7959 Deering Ave., Canoga Park, CA 91304, (213) 703-1121.

CIRCLE INQUIRY NO. 324

600-Megabyte Disk Drive

Two models of the Trident family of removable pack disk drives, the T-600 and T-602, will each provide up to 624.2 MB of storage (unformatted) in a single enclosure.

The higher performance of the new models will allow track densities of 740 tracks per inch; 1646 cylinders are also available. The units differ from each other in available options and interface signal levels.

For details contact Century Data Systems, 1270 N. Kraemer Blvd., Anaheim, CA 92608.

CIRCLE INQUIRY NO. 132

Disk Controller for Apple II

Disk 2+2 is a single density 8" floppy disk controller for the Apple II computer. It increases the power and flexibility of the Apple by increasing the data on line and individual file size, and by reducing the number of disks handled by the user.

The unit will control up to four industry standard 8" floppy disk drives under either Apple DOS or assembly language control.

Two Apple business packages have been configured to run with Disk 2+2, the Osborne General Ledger package and the ROM-based Financial Management System.

Available from Apple dealers. For details contact Sorrento Valley Associates, 11722 Sorrento Valley Rd., San Diego, CA 92121.

CIRCLE INQUIRY NO. 133

Flexible Diskettes

Verbatim Corporation has available a line of high performance 8-inch flexible diskettes known as the Optima Series. The line includes a calibrated diskette and an alignment diskette.

Each calibrated flexible diskette has recorded values for amplitude, resolution modulation and bit shift, and can eliminate the need to develop primary or gold standard media. Alignment diskettes are used to align recording heads and are available for both single- and double-sided applications.

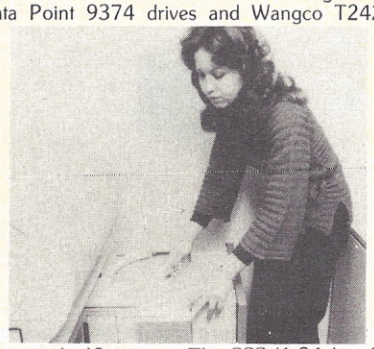
For details contact Verbatim Corp., 323 Soquel Way, Sunnyvale, CA 94086.

CIRCLE INQUIRY NO. 135

Disk Cartridges

Two top-loading disk cartridges for specific drive applications are available from the Data Recording Products Division of 3M.

The Scotch brand 933/1-48 is designed for Data Point 9374 drives and Wangco T2422



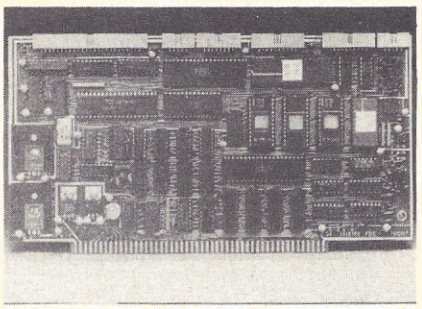
drives with 48 sectors. The 933/1-24 has 24 sectors and is designed for Data General 6070 drives. Capacity per cartridge is 10 megabytes.

For details contact 3M, Dept. DR9-4, Box 33600, St. Paul, MN 55133.

CIRCLE INQUIRY NO. 136

Disk Controller with I/O

Teletek's FDC-1 combines an intelligent single or double-density floppy disk controller with the I/O normally required in a microcomputer system. It can be configured as the central pro-



cessor in an S-100 system or as a smart floppy disk controller.

Powerful on-board software allows great flexibility in developing applications. Disk operating systems include CP/M and others.

For details contact Teletek, 976F Business Park Dr., Sacramento, CA 95827.

CIRCLE INQUIRY NO. 137

Winchester Backup

Diva, Inc. offers a 160 M/byte (80/80) removable media combination for Winchester backup on disk storage subsystems for DEC and other minicomputers.

It is offered with the Computroller V disk controller which features software transparent operation to host processors and system emulation of original manufacturer disk subsystems.

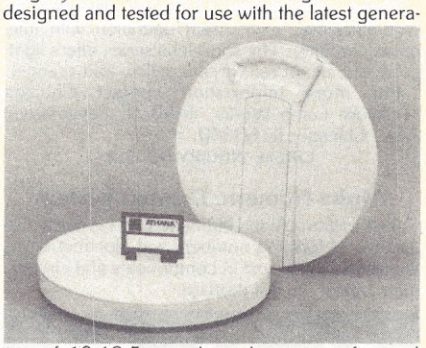
In its Winchester backup combination, the DEC user can get an 80 M/byte (unformatted) Winchester drive and an 80 m/Byte (unformatted) removable storage module device which, with the Computroller V, allows both to transfer at 1209 up to K/byte per second.

For details contact Diva, Inc., 607 Industrial Way, Eatontown, NJ 07724, (201) 544-9000.

CIRCLE INQUIRY NO. 139

10-12.5 Megabyte Disk Cartridges

Athana has introduced a complete line of front and top loading disk cartridges for 10-12.5 megabyte drives. These new cartridges have been designed and tested for use with the latest genera-



tion of 10-12.5 megabyte drives manufactured by Data General, Hewlett-Packard and Wangco. All units are certified to OEM standards.

For details contact Athana Magnetic Media, 1815 Mullen Ave., Torrance, CA 90510.

CIRCLE INQUIRY NO. 140

HP 3000 Disk Systems

Microcomputer Systems Corporation offers two disk systems that provide Hewlett-Packard 3000 computers with up to four times as much storage capacity per disk drive as HP's largest disk drive.

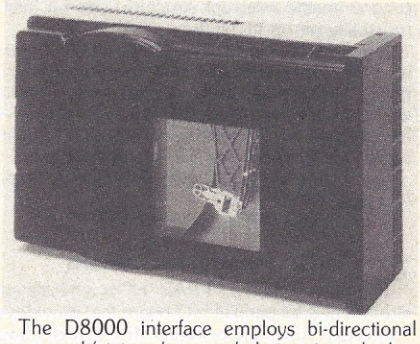
The MSC systems are based on newly-developed MSC 1694 and MSC 1696 intelligent disk controllers. The 1694 handles up to eight industry standard disk drives with capacities of 300 megabytes and the 1696 handles up to eight 600-megabyte drives.

For details contact Microcomputer Systems Corp., 432 Lakeside Dr., Sunnyvale, CA 94086.

CIRCLE INQUIRY NO. 143

8" Fixed Disk Drive

Pertec's new Model D8000 8.25" fixed media disk drive is mechanically interchangeable with an 8" floppy disk drive, uses Winchester technology and has a capacity of 20 megabytes.



The D8000 interface employs bi-directional command/status bus and byte-oriented data transfer to simplify communications between the drive and the computer. The unit records at a density in excess of 6,000 bits per inch and transfers data at a rate of 0.87 megabytes per second.

For details contact PCC/Peripherals Div., 9600 Irondale Ave., Chatsworth, CA 91311.

CIRCLE INQUIRY NO. 141

8" Winchester Disk

The Series 7000 are compact 8" Winchester disk drives that store up to 20M bytes while occupying only 0.39 cubic feet of console space. The drives have unformatted capacities of 4M bytes in the single-disk version, 12M bytes in the double-

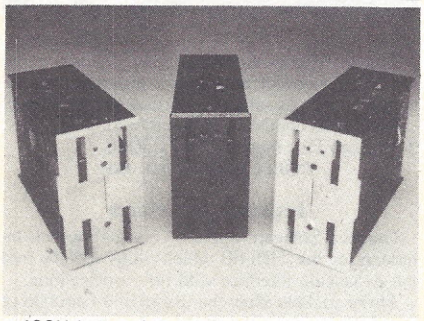
platter model and 20M bytes in the 3-disk unit. Two drives may be mounted side-by-side in a standard 18" rack. Included are drive-control and interface circuits for seeking, writing, reading and fault detection.

For details contact Kennedy Co., 1600 S. Shamrock Ave., Monrovia, CA 91001.

CIRCLE INQUIRY NO. 142

5¼" Dual Floppy Disk Drive

This 5¼" dual floppy disk drive has been designed to be used with high quality electronic computers, word processing equipment and intelligent terminals. It packs two reliable disk drives with speed and increased storage capacity into a standard 3¼" x 5¾" x 8½" package.



400K bytes of usable information (10 sectors of 512 bytes, dual density format, 40 tracks) may be stored on two standard 5¼" diskettes. The unit will access random at 12 ms per track seek time with a head load time of 15 ms.

For details contact Energy Equipment, Inc., P.O. Box 4180, Torrance, CA.

CIRCLE INQUIRY NO. 145

6800 10-Megabyte Disk

The Storage Demon is a 10-megabyte Winchester disk drive for Motorola EXORcisor or other 6800 systems. The disk provides a capacity of 19,000 512-byte sectors and is compatible with both EXORcisor I and EXORcisor II.

Software support includes SDOS, an interrupt-driven disk operating system with keyboard type-ahead, automatic disk read-ahead and disk sector pooling, dynamic files with random access to the byte, and complete device independence.

SDOS also supports EXORdisk I, II or II to allow use of these drives for data storage and/or backup of the Winchester drive.

For details contact Software Dynamics, 2111G W. Crescent Ave., Anaheim, CA 92801.

CIRCLE INQUIRY NO. 144

Extended Editor Option

Sykes Datatronics offers an Extended Editor Option for their floppy disk based Comm-Stor II Communications Storage Unit, and their Comm-Stor III Communicating Forms Entry Station.

The Extended Editor Option offers a flexible updating and revision package for data stored on fixed or variable length file diskettes, as well as with an expanded off-line message preparation capability.

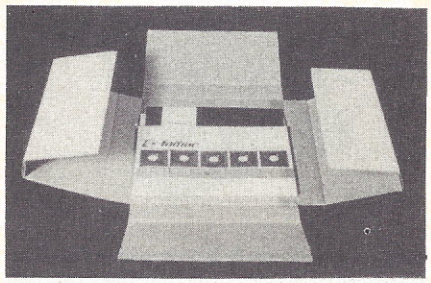
The Extended Editor Option allows the operator to edit large files, including such changes as inserting characters or complete lines of data, appending or deleting lines and replacing specified character strings.

For details contact Sykes Datatronics Inc., 375 Orchard St., Rochester, NY 14606.

CIRCLE INQUIRY NO. 146

Flexible Disk Mailer

Inmac, formerly Minicomputer Accessories Corporation, has included a flexible disk mailer to their line of minicomputer supplies and accessories. This mailer has been designed to help pro-



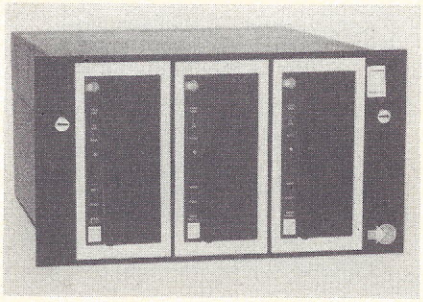
tect up to five standard flexible disks or minifloppies against bending, curling or cupping in transit. The mailer is easy to assemble with instructions printed on the mailer itself.

For details contact Inmac, 2465 Augustine Dr., Santa Clara, CA 95051.

CIRCLE INQUIRY NO. 147

Floppy Disk Drive Subsystem

A triple floppy disk drive development subsystem provides instantaneous visual diagnostics for each drive. The Model 4400 features a real-time indicator control panel on each drive that verifies



major disk functions to facilitate the development, debugging and operation of computer systems. The unit incorporates three 8" floppy disk drives, which provide a database of up to 1.5 Mbytes.

For details contact Innotronics Corp., Brooks Rd., Lincoln, MA 01773, Stephen Scheuer, Mktg.

CIRCLE INQUIRY NO. 148

277-Megabyte Disk Pack Storage

Data General Corporation has a disk storage subsystem that features high capacity and low cost per byte.

Model 6122 DG/Disk Storage Subsystem provides economical on-line disk pack capacity of 277 megabytes per drive and over one gigabyte per subsystem for operation on Eclipse models S/250, C/350 and M/600 equipped with a Burst Multiplexor Channel (BMC). The units use removable disk packs for convenient backup, security and off-line data storage.

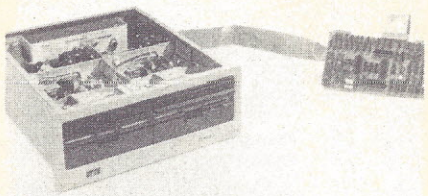
Model 6122 has a higher effective seek performance than the earlier DG/Disks because of its higher density of data storage. For example, the 277-megabyte DG/Disk covers 92 megabytes of data in the same amount of time it takes to span 63 megabytes on a 190-megabyte DG/Disk.

For details contact Data General Corp., Route 9, Westboro, MA 01581.

CIRCLE INQUIRY NO. 323

Diskette Hardware System

This Multibus compatible system is hardware and software compatible to Intel's MDS-800 and Series II computers. The ZX-710/720 provides a complete bulk storage system that can operate with single or double density recording formats.



The ZX-710/720 replaces Intel's MDS-710, 720, 2DS, DDS and SBC-201, 202, 211, 212. Shugart SA801 drives are houses horizontally in a 19" rack mountable chassis.

For details contact Zendex Corp., 6398 Dougherty Rd., Dublin, CA 94566, (415) 829-1284.

CIRCLE INQUIRY NO. 325

Terminal to Computer

Comander FX and MX provide a basic computer system for terminal enhancement for less than $2000 in quantity 50. The floppy-based FX contains 1 Mbytes disk and up to 64K RAM while the minifloppy-based MX offers 160 Kbytes disk

and 48K RAM. Both systems use a Z80A CPU.

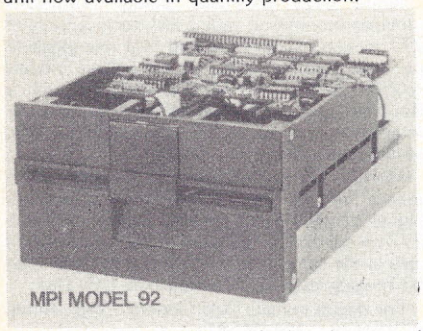
Commander computers execute programs in CBASIC, COBOL, FORTRAN and MACRO-80 Assembler under the CP/M, with field proven application packages available.

For more information contact Columbia Data Products, Computer Systems Div., 9050 Red Branch Rd., Columbia, MD 21045, (301) 992-3400.

CIRCLE INQUIRY NO. 326

Double Track Density Drives

Micro Peripherals, Inc. will begin production of mini-floppy disk drives that will read/write 96 tracks per inch, doubling the track density of any unit now available in quantity production.



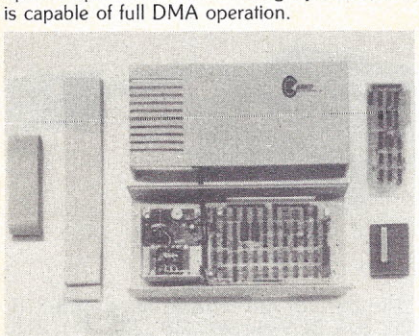
When combined with double data density and double-sided read/write features, the unit will make possible storage of nearly 1 megabyte of data on a 5.25-inch floppy disk.

For details contact Micro Peripherals, Inc., 9754 Deering Ave., Chatsworth, CA 91311.

CIRCLE INQUIRY NO. 327

Cartridge Disk Drive Controller

Cameo Data Systems has the Cameo DC-500S Cartridge Disk Drive Controller for S-100 bus microcomputers. The controller will operate up to four 10 or 20 megabyte drives and is capable of full DMA operation.



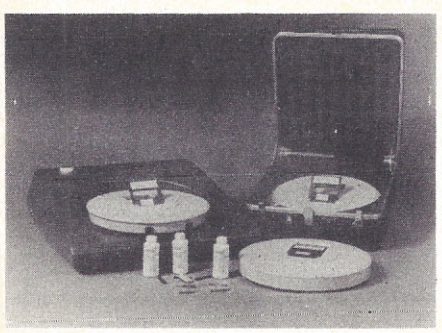
It is sold alone or as a subsystem with CDC Hawk and Ampex drives. Price of the controller alone is $1550, including cables and a CP/M compatible software driver. Diagnostic software is also available.

For details contact Cameo Data Systems Inc., 1626 Clementine St., Anaheim, CA 92802.

CIRCLE INQUIRY NO. 328

10-MByte Disk Drive Accessories

A series of accessories and maintenance equipment for the 10.4-megabyte, removable-cartridge RL02 disk drive is available from Digital Equipment Corporation.



The offering includes disk cartridges, an automatic cartridge cleaner, and enclosures for transporting and storing extra cartridges.

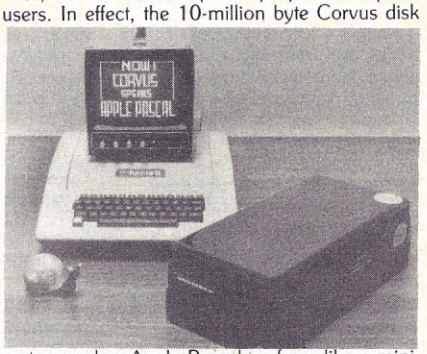
The RL02 prerecorded format contains servo information for head positioning, interleaved with data on the disk surface, to ensure proper alignment and data integrity.

For details contact Digital Equipment Corp., Maynard, MA 01754.

CIRCLE INQUIRY NO. 329

Upgrade Apple from Micro to Mini

Combining a Corvus disk system with an Apple Pascal computer brings the next generation of low cost computing power within reach of business, education and special purpose computer users. In effect, the 10-million byte Corvus disk



system makes Apple Pascal perform like a minicomputer. An advantage of Apple Pascal over most other microcomputers is its large data base and highly sophisticated processing capability.

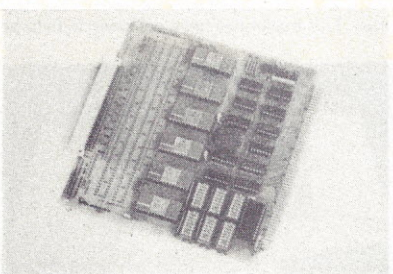
For details contact Corvus Systems Inc., 900 S. Winchester Blvd., San Jose, CA 95128.

CIRCLE INQUIRY NO. 330

I/O BOARDS

Counter/Timer

A counter/timer control board that expands the capabilities of a data acquisition system is being introduced by Dynatech R/D Company. The Dynatech 6430 Counter/Timer control board counts and times pulsed inputs with intervals



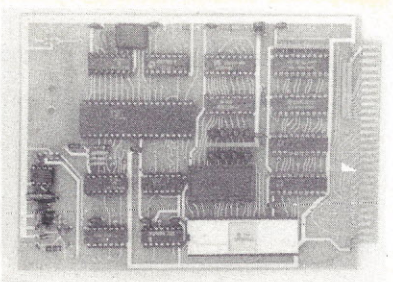
down to 2 microseconds to expand the analog and digital capabilities of the Datalogger-Plus data acquisition system. The device provides 16 I/O channels, each with a DIP switch for operator-selectable engineering conversions.

For details contact Dynatech R/D Co., 99 Erie St., Cambridge, MA 02139, Orick Kelley.

CIRCLE INQUIRY NO. 331

Serial Communications/Control

Vantage Data Products has a new single card computer for use in communications and control applications. The popular Z-80 microprocessor is used with Serial I/O, Parallel I/O, RAM and EPROM. The card comes assembled and tested,



ready for customer programs on either 2K-2716 or 1K-2708 EPROMs. Serial communications are asynchronous RS-232 and programmable to all the standard baud rates.

For details contact Vantage Data Products, 550 W. 200 S., Suite 8, Provo, UT 84601.

CIRCLE INQUIRY NO. 332

64-Line Interface for LSI-11 Micros

The DRV11-J is a high-density parallel interface that provides 64 input-output data lines for LSI-11/23 and LSI-11/2 microcomputers and their packaged counterparts. The unit features a programmable interrupt structure with bit interruptability on up to 16 lines.

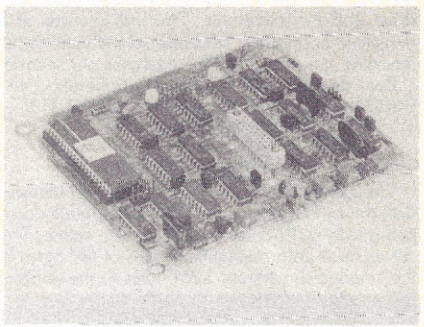
The DRV11-J interface's 64 lines are organized into four ports, and data direction for each port is program selectable, requiring no hardware alteration. Choose up to 16 processor inputs — bit interrupts on 16 data lines, or four I/O interrupts (one per port) and 12-bit interrupt lines.

For details contact Digital Equipment Corp., Maynard, MA 01754.

CIRCLE INQUIRY NO. 149

8-Bit Parallel I/O Board

The MFE Option 214 PAR"H" is a hostile environment 8-bit parallel I/O board that provides a "universal" interface between MFE 250BH hostile environment digital cassette tape transports



and any mini or microcomputer in military and industrial applications.

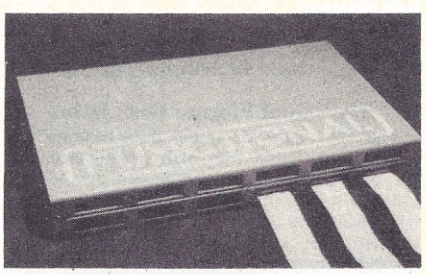
It provides 95+% of the required I/O circuitry and timing control; users supply only address line decoding.

Contact MFE Corp., Keewaydin Dr., Salem, NH 03079, (603) 893-1921, Jim Saret.

CIRCLE INQUIRY NO. 150

Firmware Bus Controller

The F6470 Switching Element is a firmware bus controller that automatically manages information traffic within a loosely coupled network of autonomous microprocessing elements operating in parallel.



Transparent to the OEM system builder, the switching element allows any processor in the network to access any other processor's memory.

For details contact Functional Automation, Inc., 3 Graham Dr., Nashua, NH 03060.

CIRCLE INQUIRY NO. 151

Joystick Interface

Creative Software offers a versatile joystick interface for the TRS-80 which plugs directly into the expansion interface with no modifications.

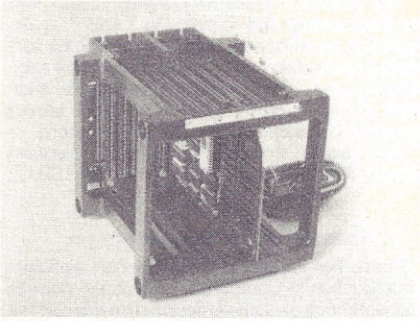
Three sockets allow the use of one Fairchild or two Atari joysticks for single or two person interactive games and input. Both types of joysticks can sense eight compass directions.

Each interface comes with a separate power supply, two games and complete instructions. For details contact Creative Software, P.O. Box 4030, Mountain View, CA 94040.

CIRCLE INQUIRY NO. 152

Card Racks with Motherboard

A new family of card racks containing an STD bus motherboard and card edge connectors is offered by Pro-Log Corporation. The racks are designed to hold all standard 4½" x 6½" STD bus integrated circuit cards.



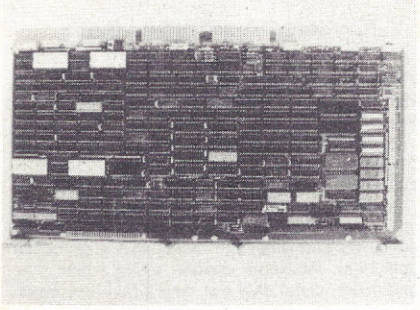
Available in four-, eight-, and sixteen-slot configurations, the card racks feature open end panels and improved convection cooling to promote long card life and high reliability.

For details contact Pro-Log, 2411 Garden Rd., Monterey, CA 93940, (408) 372-4593.

CIRCLE INQUIRY NO. 333

Single-Board Controller

Microcomputer Systems Corporation has an intelligent, single-board controller that interfaces Digital Equipment Corporation's Unibus with Winchester and other standard SMD interface high-capacity disk drives.



Standard features include command chaining, automatic error correction and retry recovery, implied overlapped seek, automatic head and cylinder switching, and DMA load regulation.

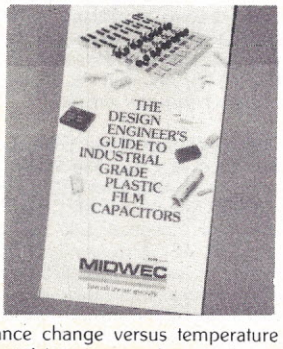
For details contact Microcomputer Systems Corp., 432 Lakeside Dr., Sunnyvale, CA 94086.

CIRCLE INQUIRY NO. 334

LITERATURE

Guide to Selecting Capacitors

"The Design Engineer's Guide to Industrial Grade Plastic Film Capacitors" helps engineers select capacitors to fit their needs. The pamphlet contains two tables giving a partial list of capacitors,



capacitance change versus temperature and insulation resistance versus temperature.

For a free copy or details, contact Midwec, P.O. Box 417, Scottsbluff, NE 69361, J. Fisher.

CIRCLE INQUIRY NO. 335

Free Brochure on Epoxies

Amicon Corporation has available a free brochure describing their line of conductive and insulating adhesives and coatings created for electronic/microelectronic applications such as semiconductor, hybrid and circuit manufacturing.

Their conductive adhesives can be used for chip bonding and hybrid circuit assembly as well as "cold soldering" resistors, flat packs and hybrids.

Silver-filled conductive and thermal coatings can create conductive paths on PC boards, provide rigid chemical-resistant coatings on substrates or thin flexible coatings on plastic films.

For a copy or details contact Amicon Corp., 25 Hartwell, Ave., Lexington, MA 02173.

CIRCLE INQUIRY NO. 153

Brochure for Small Business

Pathways Through Data Processing: Small Business Systems is a report designed to lead the small businessperson through the intricacies of small business computers.

Included in this 200-page report is a complete description of a small business system, in terms of terminals, computers, peripherals, system software and data communications. The business microcomputer and minicomputer are carefully delineated and compared.

Price is $55. For details contact Management Information Corp., 140 Barclay Ctr., Cherry Hill, NJ 08034, (609) 428-1020.

CIRCLE INQUIRY NO. 154

OIS/3270 Brochure

Wang Laboratories' communications protocol OIS/3270, described in a one-page brochure, allows interactive communications with a computer and lets operators access information from a central database.

By emulating the 3271 controller with 3277 display stations and 3288 printers, data can be entered into a computer or received from it via telephone lines connected to any Wang Office Information System.

Contact Wang Laboratories, Inc., One Industrial Ave., Lowell, MA 01851, (617) 851-4111.

CIRCLE INQUIRY NO. 155

EDS Product Catalog

Educational Data Systems, Inc. has available a 16-page product line catalog. The catalog is divided into two major sections, Hardware and Software and contains product photographs, configuration charts, pricing and ordering instructions.

Each section of the catalog provides product descriptions, typical applications, options available, etc.

For a copy or details contact Educational Data Systems, 1682 Langley Ave., Irvine, CA 92714.

CIRCLE INQUIRY NO. 156

'How-To' Book from Essex

An updated edition of *How to Start Your Own Systems House* is now available from Essex Publishing. The book is primarily for the enterprising EDP professional who would like to start his own microcomputer business.

Market Selection and Evaluation, Industry Application Opportunities, Equipment Selection, Evaluation of Vendors, Becoming a Dealer/Distributor, Effective Advertising, Product Pricing, Selling Cycle, and Staying Ahead of Competition are some of the subjects discussed at length.

For details contact Essex Publishing, 285 Bloomfield Ave., Caldwell, NJ 07006.

CIRCLE INQUIRY NO. 336

BASIC Programs for TRS-80

32 Basic Programs for the TRS-80 by Tom Rugg and Phil Feldman has been published by dilithium Press. It contains full documentation for a variety of programs including games, math, educational exercises, applications and graphics and miscellaneous programs, all bug-free and ready to key into your TRS-80.

Software tapes are also available to accompany the book with 6-8 ready-to-run programs that can also be adapted to specific uses.

The book has 290 pages. Price $15.95. Tapes $9.95 each, set of five $49.95. For details contact dilithium Press, P.O. Box 92, Forest Grove, OR 97116.

CIRCLE INQUIRY NO. 157

Brochure on Computer-Based Shipping Rate Directory

A brochure describing Numerax's computer-produced and maintained directory of the shipping rates and tariffs charged by United States motor and package carriers is available free.

The brochure describes how the directory, *Quick Rate,* can be used to check and quote freight rates, to calculate proper freight charges for auditing freight bills and/or charging freight rates back to the customer, and so on.

For a copy or details contact Numerax, Inc., 230 W. Passaic St., Maywood, NJ 07607.

CIRCLE INQUIRY NO. 158

Brochure on Minicomputer

A low-cost, powerful computer system that executes industry-standard 370 software without any reprogramming is described in a brocure available from Two Pi Corporation.

Designated the V/32, the minicomputer can process IBM 370 programs and can use standard IBM and IBM plug-compatible peripherals — printers, tapes, data entry terminals, disk drives and the like.

For a copy or more information contact Two Pi Corp., 3105 Patrick Henry Dr., Santa Clara, CA 95050.

CIRCLE INQUIRY NO. 159

Computer Book Catalog

A catalog featuring a large selection of computer and computer-related titles has been released by Howard W. Sams & Co., Inc.

Organized for quick reference into five areas — Basics, Programming, Computer Technology, Reference and Computer-Related — the catalog details books that are directed to a wide range of people and interests.

For a copy or details contact Howard W. Sams & Co., Inc., 4300 W. 62nd St., Indianapolis, IN 46206, Robert Soel, Adv. Coordinator.

CIRCLE INQUIRY NO. 160

HP Application Note

"Minicomputer Analysis Techniques Using Logic Analyzers," is a 16-page booklet written for designers and users of minicomputer systems.

The booklet includes theory and examples of procedures for software evaluation, code optimization, performance analysis, and troubleshooting complex digital systems.

Ten applications illustrate the use of logic analyzers with system crashes, complex program tracing, asynchronous buses, and turn-on failures.

For a copy contact Hewlett-Packard Co., 1507 Page Mill Rd., Palo Alto, CA 94304, Inq. Mgr.

CIRCLE INQUIRY NO. 161

Tymnet Subscribers Directory

Tymnet, Inc., has a 34-page Subscribers Directory that is divided into three sections, and describes over 200 databases offered through the Tymnet network.

The databases cover a broad range of categories including medical, financial, commercial, and scientific information. Also listed in the directory and is the source of each database.

Price is $5. For details contact Tymnet, Inc., 20665 Valley Green Dr., Cupertino, CA 95014.

CIRCLE INQUIRY NO. 162

Revised Standard Issued for Vehicle-Mounted Elevating Devices

The safety of workers using vehicle-mounted aerial devices to lift them to their job sites is the main objective of a revised national standard published by ANSI.

The publication is a new edition of a standard issued in 1969. The revision was made because of changes in technology and state of the art.

The standard sets forth criteria for design, manufacturing, testing and inspection of equipment, and outlines the responsibilities of manufacturers, dealers, installers, owners and users.

For details contact American National Standard Institute, Inc., 1430 Broadway, New York, NY 10018, (212) 354-3311, Dorothy Hogan.

CIRCLE INQUIRY NO. 163

Local Data Distribution Brochure

TeleProcessing Products, Inc. has prepared an 8-page "Product Profile" on its line of Local Data Distribution products. Included are a brief description of each product, its operation and features.

Contact TeleProcessing Products, Inc., 4565 E. Industrial St., Bldg. 7K, Simi Valley, CA 93063, (805) 552-1849.

CIRCLE INQUIRY NO. 164

Shielding Techniques Bulletin

A 6-page illustrated bulletin on computer equipment shielding techniques has been issued by Metex Corporation's Electronic Shielding Group. Included are photos of such typical approaches as picture frame composite gaskets for

EMI/RFI shielding; diagrams of containment shielding of a switching regulator power supply, exclusion shielding of digital logic PC boards; and a drawing identifying typical shielding and static discharge problem areas in computer and process control enclosures.

For a copy or details contact Metex Corp., Elec. Shield. Group, 97 Talmadge Rd., Edison, NJ 08817.

CIRCLE INQUIRY NO. 165

OEM II Power Supply Catalog

Powertec, Inc. is offering a free 12-page two-color catalog describing its complete line of OEM II open frame DC-output power supplies.

The brochure details the benefits of these units which are available in a broad product range of single output-low power, single output-high power, dual output and triple output configurations.

Specifications include input characteristics, voltage/current ratings, regulation, output ripple, transient response and more.

For a copy or details contact Powertec, Inc., 20500 Nordhoff St., Chatsworth, CA 91311, (213) 882-0004, Bob Friedman.

CIRCLE INQUIRY NO. 167

RCA Databook

A 440-page databook on "COS/MOS Memories, Microprocessors, and Support Systems," SSD-260, has been issued by RCA Solid State Division as another volume in its series of semiconductor databooks.

The databook includes technical data, application notes, classification charts, cross-reference information, handling and ordering information.

Price is about $7. Contact RCA Solid State Div., Box 3200, Somerville, NJ 08876.

CIRCLE INQUIRY NO. 166

BK-10 Catalog

All of the B&K-Precision test instruments shown in the BK-80 "big" catalog, including 8 new products, are now featured in a condensed, compact catalog, suitable for insertion in a 6¾ size envelope.

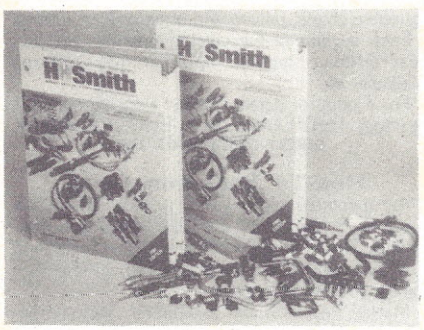
The BK-10 catalog is illustrated and describes specifications, features and applications of B&K-Precision oscilloscopes, semiconductor testers, multimeters and frequency counters, as well as specialized test instruments for CB, radio and TV maintenance and repair.

For details contact B&K-Precison/Dynascan Corp., 6460 W. Cortland St., Chicago, IL 60635.

CIRCLE INQUIRY NO. 168

H.H. Smith Component Catalog

A 104-page Component/Hardware Catalog, featuring a completely updated format to expedite easy location of product categories by design engineers and purchasing agents is now available from Herman H. Smith, Inc.



The edition details key product information and specifications along with technical illustrations and features of the more than 20,000 items the company produces.

For details contact Herman H. Smith, Inc., 812 Snediker Ave., Brooklyn, NY 11207.

CIRCLE INQUIRY NO. 340

Word Processing Guide

Wordstream Systems Group is offering a 4-page guide which details how word processing simplifies proposals and project record keeping and economically and efficiently increases the production of materials pertinent to engineering.

The booklet, "Word Processing: Capital Idea for Engineering and Consulting Firms," is designed as an office manager's manual for the successful application of word processing in the engineering environment. Applications include technical reports, proposals, environmental impact statements, standard forms and specifications.

For details contact Wordstream Systems Group, 300 E. 44th St., New York, NY 10017.

CIRCLE INQUIRY NO. 337

Introduction to Computers

Vertec has an instructional materials package, "Introduction to Computers." The audio cassette and workbook package is designed to educate the businessman who needs to evaluate the costs and benefits of computer systems, but has little prior knowledge of computer operations.

The package will aid the decision maker who has not had the previous experience necessary to understand what he is hearing in computer sales presentations. If a purchaser of even a minimal system is not armed with basic facts to evaluate existing operations, he will not be able to select a basic computer configuration; nor will he understand the benefits and features available as options to the system.

For details contact Vertec, 14279 Greenleaf St., Sherman Oaks, CA 91423.

CIRCLE INQUIRY NO. 338

Keyboard Application Book

A 14-page brochure from Cherry Electrical Products Corporation contains an introduction to solid state capacitive keyboards and valuable application data.

Specifications, detailed block diagrams and schematics give a concise description of these keyboards and show their versatility and reliability.

Special sections of step-by-step instructions and flow charts allow the user to customize Cherry keyboards and meet the needs of his particular application. Available options include data bus, handshake, serial data out, and Break key level.

For a free copy or details contact Cherry Electrical Products Corp., 3600 Sunset Ave., Waukegan, IL 60085, (312) 689-7705.

CIRCLE INQUIRY NO. 339

Office Computing Newsletter

Vantage Research offers a major new information service covering the emerging office computing industry.

The new monthly newsletter, *Office Computing Industry Report,* will focus on the convergence of small scale data processing, word processing and data communications systems which is already producing a new generation of multifunction systems for use in office automation applications by organizations of all sizes.

OCIR will also cover the merging of EDP and Business Machine distribution systems and support activities and the relationship of these new office computing systems to network based information systems and distributed data processing.

For details contact Vantage Research, 2680 E. Bayshore Rd., # 110, Mountain View, CA 94043.

CIRCLE INQUIRY NO. 341

Microcomputer Data Sheets

A new data sheet describes the Model 80-20 single-board microcomputer from R2E of America.

The new 80-20 features a Z-80 CPU, 32K of RAM, 2 single-side, double-density minifloppies (140K bytes each), ASCII keyboard, 1024 character upper/lower case CRT, parallel Centronics printer interface, cabinet and power supply.

Software includes R2E's Business BASIC with sequential, indexed sequential and random access file management.

For details contact R2E of America, 47 Bedford St., Minneapolis, MN 55414.

CIRCLE INQUIRY NO. 345

Analog Chip Data Book

Harris Semiconductor Products Division has available a 44-page data book describing its analog integrated circuits and data acquisition components. The data book presents those integrated circuits that are available as a standard product in chip form.

The Analog Chip Data Book is divided into two sections. The introductory section provides information on product assurance, testing, recommended handling, and ordering information. The characteristics section provides data on 24 individual chips with the dc and ac specifications, chip layout and a functional layout where required.

Send letterhead request to Harris Semiconductor Products Div., P.O. Box 883, Melbourne, FL 32901.

CIRCLE INQUIRY NO. 342

Computer-Aided Design Brochure

A new brochure describing the capabilities of the DDM (Design, Drafting and Manufacturing) system, a computer-aided graphics system, is available from Calma.

The DDM system provides interactive computer assistance for the entire design process from initial concept, through the production of finished engineering drawings and the actual generation of computer-readable tape to drive numerically controlled production machinery.

The typical DDM system consists of a computer, plotter, digitizer, 300 megabytes disk, magnetic tape unit and up to six dual screen consoles.

For details contact Calma, 527 Lakeside Dr., Sunnyvale, CA 94086.

CIRCLE INQUIRY NO. 343

Computer-Based Nuclear Control

An international report on principles to be followed in the day-to-day use of digital computers for alarm, instrumentation, record, control and equipment protection purposes on nuclear reactor units was made public by the International Electrochemical Commission. As an interim step to a full-scale international standard, the report, designated IEC Publication 643, has been developed by the international body in view of the general use of process computers with nuclear reactor units.

While logging remains the basic function of many computer systems, widespread use is now made of computers as a means of enhancing conventional instrumentation and of obtaining information not otherwise available.

Assigning tasks vital to plant operation (which includes the nuclear reactor and its protections systems, coolant systems and electrical supplies necessary for generating electricity or providing thermal power) to computer systems requires careful consideration of the factors affecting availability and reliability, when determining the system configuration.

For details contact IEC, 1, Rue de Varembe, 1211 Geneva 20, Switzerland.

CIRCLE INQUIRY NO. 344

Bubble Memory Report

A 12-page reliability report for the 7110 one-megabit bubble memory is available from Intel Magnetics, Inc.

The report reviews a complete life test program implemented to determine the reliability level of the Intel 7110, including environmental and longevity testing.

Data gathered to date shows that the 7110 bubble memory is a reliable product and meets its target specifications for environmental durability and functional performance.

Included in the reliability report are sections on the 7110 product description, the quality assurance program, the reliability test results and system level and life tests.

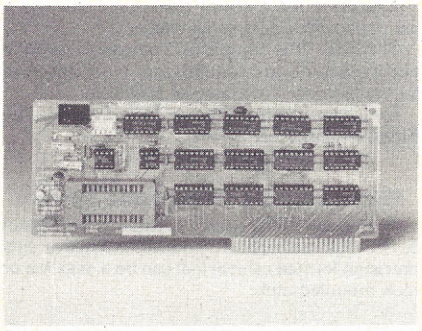
For a copy or more information contact Intel Literature Dept., 3065 Bowers Avenue, Santa Clara, CA 95051.

CIRCLE INQUIRY NO. 346

MEMORY BOARDS

RomWriter™ for Apple

RomWriter EPROM programmer is designed to permit the Apple Computer owner to program 2K 2716 (5V) EPROMs. It can be situated in any peripheral slot, except 0.



EPROMs to be programmed mount in a zero-insertion force socket, and all or part can be programmed and its contents verified without moving PROM to another location.

For details contact Mountain Hardware, Inc., 300 Harvey West Blvd., Santa Cruz, CA 95060.

CIRCLE INQUIRY NO. 169

Super Dazzler

The Cromemco Super Dazzler is a high-resolution graphics interface designed for use in Cromemco computer systems. The Super Dazzler Interface (SDI) can be used to display color or black-and-white images with up to 756 by 484 point resolution. The SDI circuitry is contained on just two cards.

The SDI uses direct memory access to display the contents of a display memory. Each pixel of the display may be mapped from one nybble or from one bit of the display memory. Bit-mapped or nybble-mapped mode is software selectable.

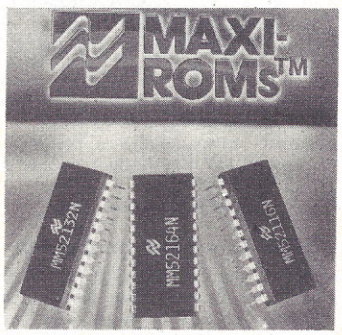
The SDI may be used to display a picture in color or black-and-white. In color operation, up to 4096 colors can be selected.

The two-board Super Dazzler Interface (Model SDI) is $595. The 16K two-port memory card (Model 16KTP) is $795. For details contact Cromemco, Inc., 280 Bernardo Ave., Mountain View, CA 94043, (415) 964-7400.

CIRCLE INQUIRY NO. 347

16K, 32K and 64K ROMs

A complete family of static 16K, 32K and 64K bit read only memories with JEDEC approved pinouts is now available from National Semiconductor Corporation.



The parts are fabricated using the company's proprietary four ion-implant dual enhancement/depletion mode N-channel MOS process. They include the 2K x 8-bit MM52116, the 4K x 8-bit MM52132 and the 8X x 8-bit MM52164, static devices. All are TTL compatible and operate from a single +5 volt supply.

For details contact National Semiconductor Corp., 2900 Semiconductor Dr., Santa Clara, CA 95051, (408) 737-5000.

CIRCLE INQUIRY NO. 348

64K EPROM from TI

The TMS2564 64K-bit EPROM features the operating characteristics of all members of Texas Instruments' single-supply EPROM family. It requires only a single 5V power supply; has 8-bit word configuration; features fully static operation; has automatic chip-select/power down and less than 500 milliwatts power-dissipation typical.

The TMS2564 is offered in a 600-mil wide 28-pin dual-in-line hermetic package, compatible with the industry standard 64K ROM and other members of the single-supply EPROM family. Operation is guaranteed from 0 to 70°C.

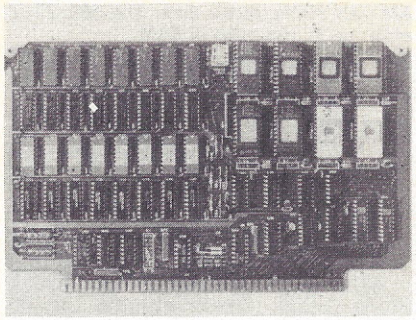
Programming the TMS2564 requires only a single TTL-level pulse per location and can be done singly or in blocks, sequentially or at random. A number of commercially available PROM programmers are capable of programming the TMS2564.

For more information contact Texas Instruments Inc., MOS Memory Division, P.O. Box 1443, M/S 6955 (Attn: TMS2564), Houston, TX 77001.

CIRCLE INQUIRY NO. 170

Single Board Memory System

Phoenix Digital offers a 6800 Single Board Memory System containing a 16K RAM plus 32K EPROM and/or ROM. Designated the PCM 16-32, it is fully compatible with M6800, 6801, 6809 and 650X series microcomputers



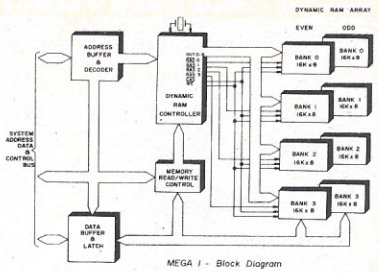
and replaces two or more cards in the Motorola EXORciser and EXORterm type products. It is designed for 1 to 1 MHz operation with RAM expansion in 4K block increments to a full 16K.

For more information contact Phoenix Digital Corp., 3027 N. 33rd Drive, Phoenix, AZ 85017, (602) 278-3591.

CIRCLE INQUIRY NO. 171

MEGA-1

MEGA-1 is a 128K byte read/write memory contained on a single Multibus compatible card. It may be used in either 8-bit or 16-bit systems. When fully populated the card contains 64 16K dynamic RAMs; however, to the user it appears



MEGA I - Block Diagram

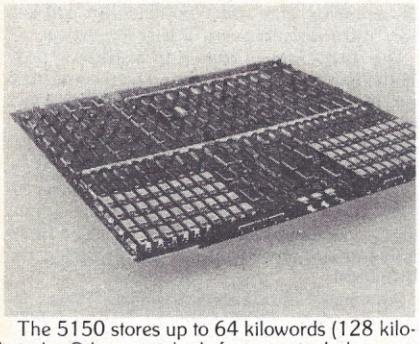
as static RAM having a 375ns access time and a 480ns cycle time. A dynamic RAM controller performs all distributed memory refresh functions and resolves any conflicts between refresh cycle requests and read or write cycle requests.

For details contact Matrox Electronic Systems Ltd., 5800 Andover Ave., Montreal, Que. H4T 1H4, Canada.

CIRCLE INQUIRY NO. 173

Add-In Memory Board

The Intel 5150 is a multifunction add-in memory board featuring high-speed on-board memory cache memory for the Data General Eclipse.™ The board improves memory system performance and reduces Eclipse system costs.



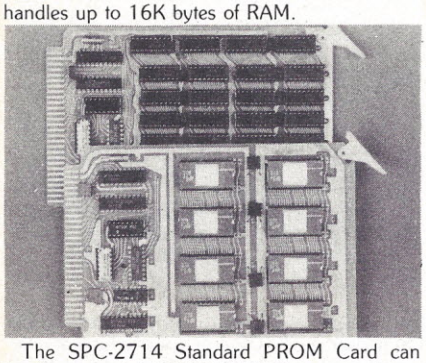
The 5150 stores up to 64 kilowords (128 kilobytes). Other standard features include error checking circuitry (ECC), error logging and error display, address select DIP switches and low power dissipation.

For details contact Intel Corp., 3065 Bowers Ave., Santa Clara, CA 95051.

CIRCLE INQUIRY NO. 174

Memory Cards for STD Bus

The SRC-2712 Standard RAM Card is capable of handling either AMD's 9124 RAM or 2114 RAM with 300ns access time. The SRC-2712 handles up to 16K bytes of RAM.



The SPC-2714 Standard PROM Card can handle up to eight 2716 EPROMs or a combination of EPROM and RAM. The card is addressed through the use of an 82s23 bipolar PROM.

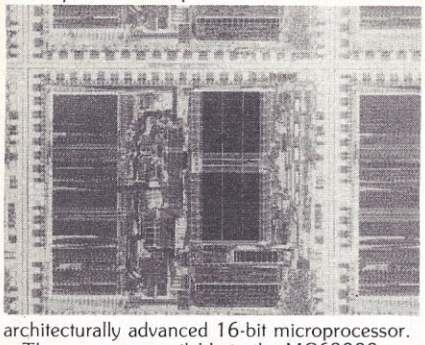
For details contact Northwest Microcomputer Systems, 749 River Ave., Eugene, OR 97404.

CIRCLE INQUIRY NO. 175

MICROCOMPUTERS

16-Bit Microprocessor

The MC68000 is a VLSI high density N-channel, silicon-gate depletion load microprocessor from Motorola. It combines state-of-the-art technology and advanced circuit design techniques with computer sciences to achieve an



architecturally advanced 16-bit microprocessor.

The resources available to the MC68000 user include 32-bit data and address registers, 16 megabyte addressing range, 56 powerful instruction types, memory mapped I/O and more.

For details contact Motorola Semiconductor Group, P.O. Box 20912, Phoenix, AZ 85036.

CIRCLE INQUIRY NO. 129

CPU Card/Microcomputer

Percom Data Company offers the SBC/9™, a 6809 SS-50 bus central processor card that may be used to upgrade SS-50 bus microcomputers or as a stand-alone control computer.

The card includes its own operating system, called PSYMON™ (Percom System Monitor) in a 1K ROM plus provision for an additional 1K of ROM. Also included on board are 1K of RAM, a 110-baud to 19.2 kbaud clock generator and a full duplex RS-232C serial interface.

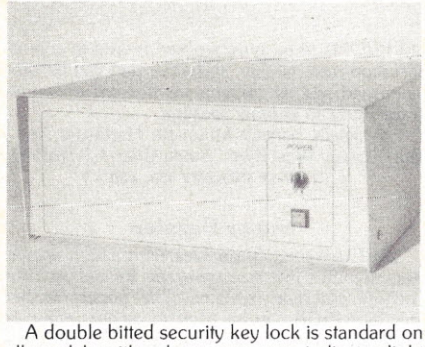
The SBC/9 is completely compatible with the existing SS-50 bus, requiring no modification of the motherboard, memory or I/O slots.

For details contact Percom Data Co., 211 N. Kirby, Garland, TX 75042.

CIRCLE INQUIRY NO. 172

Microcomputer Mainframe System

The Model 2018 system consists of an 18-slot S-100 bus motherboard housed in a heavy duty precision formed cabinet that can be a desk top or rack mounted unit.



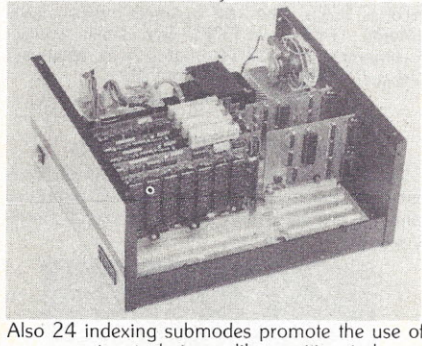
A double bitted security key lock is standard on all models with a large power-on indicator light built into the reset switch.

For details contact CMC Marketing Corp., 10611 Harwin Dr., #406, Houston, TX 77036.

CIRCLE INQUIRY NO. 299

'Mighty Micro'

The SWTPC S/09 computer uses the Motorola MC6809 8-bit processor. It features more addressing modes and an optimized consistent instruction set enhanced by 16-bit instructions.



Also 24 indexing submodes promote the use of programming techniques like position independent code, re-entrancy and recursion.

For details contact Southwest Technical Products Corp., 219 W. Rhapsody, San Antonio, TX 78216, (512) 344-0241.

CIRCLE INQUIRY NO. 176

Z-80 Based Microcomputer

Concept III is an S-100 bus computer all in its terminal cabinet except for disk drive and printer. The 8-inch fast-response dual disk drive is mounted in a small companion cabinet that includes a 50 diskette file drawer. A 150 cps impact printer completes the hardware.

Included with Concept III is a business application software package containing processes for every aspect of small business operations, applicable to retailer, wholesaler, manufacturer, service, professional.

For details contact Datasolve Computer Systems, 2711 N. 24 St., Phoenix, AZ 85008, (602) 955-2708.

CIRCLE INQUIRY NO. 178

Microprocessor-based PBX

By incorporating a Texas Instruments TMS 9900 microprocessor, Digital Telephone Systems, Inc. has introduced a compact and full-featured PBX designed for use in small configurations from 8 to 55 lines and up to 12 trunks.

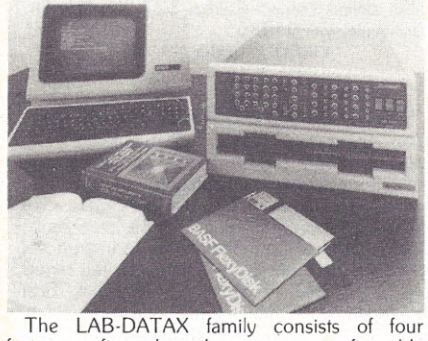
Designated the DLS-1™ series the PBX comes in both a business version called the "ProtoCall"™ and a hotel/motel version called the "InnCom"™ system.

For details contact Digital Telephone Systems, Inc., P.O. Box 1188, Novato, CA 94947.

CIRCLE INQUIRY NO. 180

Microcomputer-based Laboratory

Data Translation offers a family of microcomputer-based, instrumentation-packaged analog input/output systems that provide total solutions to many laboratory automation requirements.



The LAB-DATAX family consists of four factory-configured and one user-configurable models, each with DEC LSI-11/2 CPU, 64K RAM and instruction sets for both fixed- and floating-point arithmetic.

For details contact Data Translation, 4 Strathmore Rd., Natick, MA 01760.

CIRCLE INQUIRY NO. 181

Shared Resource Processing Systems

Xmark Corporation offers a new line of shared resource information processing systems including the Office Mate standalone system. It features an intelligent input terminal, 48K RAM, two built-in 5¼" double-sided, double density

floppy disk drives, the high speed NEC "Spinwriter" printer, and field-proven Xmark software.

Other systems include the Mini Cluster which was developed for general office applications requiring more than one workstation, and Maxi Cluster, a hard disk system designed for multiple users.

For details contact Xmark Corp., 3176 Pullman St., #119, Costa Mesa, CA 92626.

CIRCLE INQUIRY NO. 182

Zeda 580

Zeda Computers International offers the Zeda 580, a completely self-contained microcomputer with central processing unit, CRT display and dual minifloppy disk drives housed in a desktop-sized metal cabinet.

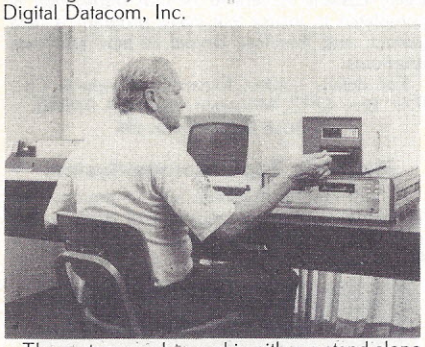
The heart of the CPU with its 65K of dynamic RAM, is a 4 MHz, Z-80A microprocessor. The system supports two RS-232 serial ports, two parallel ports, a parallel printer port, a hard disk port, and one floppy disk drive connector.

For details contact Zeda Computers International, 1662 W. 820 North, Provo, UT 84601.

CIRCLE INQUIRY NO. 183

Production Control System

A low-cost turnkey production control system (PCS) that can be used to track, control, and measure the movement of work through a manufacturing facility in near real time is available from Digital Datacom, Inc.



The system can be used in either a stand alone mode or as a terminal subsystem in a distributed data processing environment. A PCS consists of one series 232-2 Data Station, a CRT terminal/console, a hard copy printer, from one to thirty card/badge readers and applications programs.

For details contact Digital Datacom, Inc., 1600 Dove St., #420, Newport Beach, CA 92660.

CIRCLE INQUIRY NO. 184

Word/Data Processing for Microstar

Micro V announces a feature which integrates word processing with data processing in the Microstar business computer system. The combination gives greater operating simplicity to the word processor and also permits switching from

one function to the other whenever necessary.

Word processing is accomplished under the STARDOS multi-user operating system which normally provides data processing needs such as order entry, accounting and inventory control.

For details contact Micro V Corp., 17791 Sky Park Cir., Irvine, CA 92714.

CIRCLE INQUIRY NO. 186

Microcomputer from Xerox

Shasta General Systems announces the Xerox Diablo 3000 small business computer, manufactured by Xerox. All field-proven application packages available on the Xerox Diablo 3200, including those for manufacturers and wholesalers, accounting and legal firms, medical and dental professionals, contractors, printers, country clubs, retailers, insurance brokers and realtors, and many more, can now operate on the Xerox Diablo 3000.

The system consists of a compact desk top console with video display and two magnetic disk drives, a movable keyboard and high quality printer with a choice of 32, 48 or 64 thousand characters of dedicated RAM with parity.

For details contact Shasta General Systems, 895 Stanton Rd., Burlingame, CA 94010.

CIRCLE INQUIRY NO. 185

Pascal Computer with Microengine

The ACI-90™ is an advanced 16-bit Pascal computer system which incorporates up to 2M bytes of mass storage with two built-in Shugart 8" floppy disk drives. It will provide Pascal compiling speeds in excess of 1200 lines a minute. The ACI-90 executes Pascal P-code directly.

Incorporating 64K of RAM and switching power supply with "brown-out" protection, the ACI-90 includes the UCSD Pascal Operating System which has two editors, Pascal compiler, file handler and linker.

The ACI-90 is available in single or double density operation with two Shugart 800 single-sided or 850 double-sided floppy disk drives.

For more information contact Associated Computer Industries, 17952A Sky Park Cir., Irvine, CA 92714.

CIRCLE INQUIRY NO. 187

Data Acquisition/Control Systems

Technico Inc. has a series of microcomputer systems for digital and analog data acquisition/industrial control. Designated the DAS-16, this series features the Technico 16-bit microcomputer module along with analog I/O modules designed jointly by Technico and Analog Devices.

The DAS-16 provides I/O flexibility and can be configured to provide anywhere from 128 to 976 digital control points. The analog I/O section can be expanded to accommodate 256 single-ended or 128 differential inputs while also providing 16 digital to analog output ports.

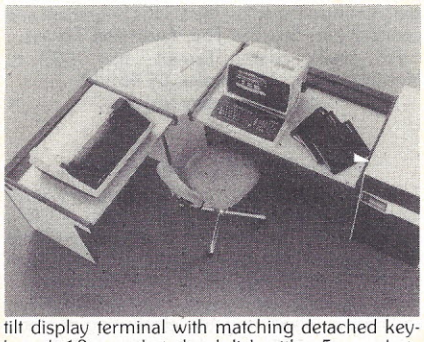
The system can output acquired data to a 3M cassette unit or up to four 8" floppy disk units. Six RS-232C terminals, CRTs or printers, or modem interfaces can be supported.

For details contact Technico Inc., Computer Products Group, 9051 Red Branch Rd., Columbia, MD 21045, (301) 596-4100.

CIRCLE INQUIRY NO. 188

Compal 9000 Computer System

The Model 9000 is designed for business and office environments that require a compact, easy to use system. In its standard configuration, the system hardware includes a 16-bit microNova 602 processor, 64K RAM memory, swivel and



tilt display terminal with matching detached keyboard, 10 megabyte hard disk with a 5 megabyte removable cartridge and high speed matrix printer.

For details contact Compal, Inc., 6300 Varial Ave., Woodland Hills, CA 91604.

CIRCLE INQUIRY NO. 191

New Micro Development Tool

Synertek Systems Corporation has available a low-cost Micro Development Tool for users of the 6500 series microprocessor family. The new MDT 1000, enables the user to write programs and debug both hardware and software.

The MDT 1000 includes the following hardware: 54-key keyboard and case; 12" (black/white) video monitor; dual cassette interface; power supply; EPROM programmer; 4K byte static RAM board; CPU board with both serial and parallel printer interfaces; video interface; sockets for four ROMs, system RAM and ACIA for serial communications; and a four-slot motherboard with two sockets installed.

For details contact Synertek Systems Corp., 150 S. Wolfe Rd., Sunnyvale, CA 94086.

CIRCLE INQUIRY NO. 189

Onyx Microcomputer

The C8000 microcomputer from Onyx Systems, Inc. incorporates a 4 MHz Z-80 based CPU, a 10-megabyte rigid disk, and a 12-megabyte cartridge tape drive in a compact tabletop package. The rigid disk has an average access time of 50 ms, and can be backed up with a single cartridge on the tape drive.

The C8000 simultaneously supports a full array of peripherals including a system console, serial and parallel printers, and most standard modems.

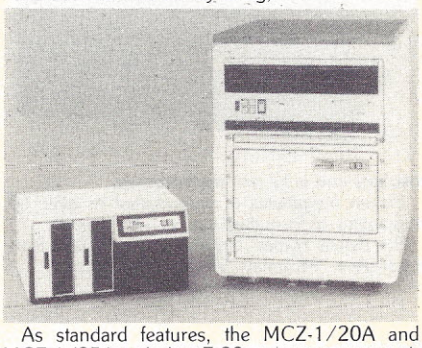
The C8000 has 64K bytes of dynamic RAM with parity, using 16K devices. Also includes a general purpose DMA controller, 3 general purpose RS232 parallel I/O ports, an 8-bit bidirectional parallel port with parity and a real time clock.

For details contact Onyx Systems, Inc., 10375 Bandley Dr., Cupertino, CA 95014.

CIRCLE INQUIRY NO. 190

Microcomputer Subsystems

Two microcomputer subsystems designed as modular building blocks for general purpose systems with business and industrial applications have been introduced by Zilog, Inc.



As standard features, the MCZ-1/20A and MCZ-1/25A include a Z-80 microcomputer with 64K bytes of RAM, interrupt-driven console capability, and floppy disk controller.

The MCZ-1/20A is a desk-top unit with integral dual floppy disk drives. The MCZ-1/25A is a rack-mounted enclosure with dual floppy or cartridge disk drives.

For details contact Zilog, Inc., 10340 Bubb Rd., Cupertino, CA 95014.

CIRCLE INQUIRY NO. 349

Mainframe System

The Model 2018 Microcomputer Mainframe System consists of an 18-slot S-100 bus motherboard housed in a heavy duty precision formed cabinet that is convertible to either a desk top or rack mounted unit. A double bitted security key lock is standard, with a large power-on indicator light built into the reset switch.

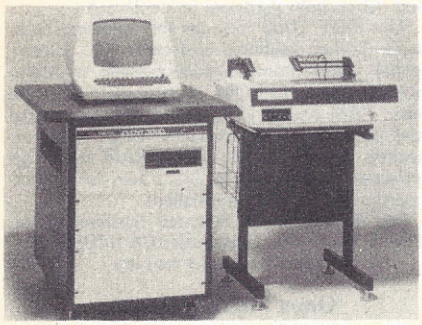
The mother provides interconnections for up to 18 printed circuit cards using the standard S-100 bus format. A jumper system provides active or inactive termination on the various signal lines. The motherboard is fully shielded.

For details contact CMC Marketing Corp., 10611 Harwin Dr., Suite 406, Houston, TX 77036, (713) 995-4960.

CIRCLE INQUIRY NO. 351

Strikes and Spares

As part of its ongoing vertical marketing strategy, Applied Data Communications (ADC) is introducing a new turnkey system specifically geared to the bowling industry.



LeagueMaster™ provides fast, accurate management of records generated by league and tournament play. It produces complete records of averages, standings, handicaps, high games, league standings and a variety of recap reports. Arithmetic errors are eliminated and lengthy computations are now available within minutes.

For details contact Applied Data Communications, 14272 Chambers Rd., Tustin, CA 92680.

CIRCLE INQUIRY NO. 350

Cromemco Z-2H

The Z-2H offers an integral 11-megabyte hard disk drive and a wide range of features including a Z-80A, 4MHz processor; two floppy disk drives; 64K RAM; an RS-232 serial interface; a printer

interface and a 12-slot motherboard.

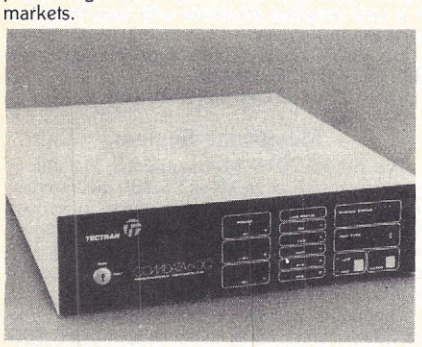
Eleven megabytes of unformatted or over 10 megabytes of formatted data can be stored.

For details contact Cromemco, Inc., 280 Bernardo Ave., Mountain View, CA 94043.

CIRCLE INQUIRY NO. 352

Australian Microprocessor Equipment

Tectran Corporation Pty. Ltd., based in Sydney, Australia, is offering microcomputer-based products to medical instrumentation, data processing and communications and avionics markets.



The COMDATA series products are communications multiplexors, concentrators and special systems which enable more efficient less costly transmission and receipt of data to remote areas.

For details contact the Australian Trade Commission, 636 Fifth Ave., New York, NY 10020.

CIRCLE INQUIRY NO. 353

Educational Computer System

Psychotechnics, Inc. (PTI) announces its Validated Computer Math System. The PTI computer features 80 ready-to-run TELEMATH programs. All eighty programs are cross-referenced to three of the leading Math basals.

The PTI TELEMATH System was developed in conjunction with the San Diego Unified School District. Teacher input and concerns were critical in the design of the programs.

For details contact Psychotechnics, Inc., 1900 Pickwick Ave., Glenview, IL 60025.

CIRCLE INQUIRY NO. 354

Audio-Visual Education System

Computer-based Audio Visual System weds color computer graphics technology with a Z-80 based microprocessor to present multi-sensory interactive lessons stored individually on single cassette tapes. The audio and digital program contained in the lesson are recorded on the tape, giving the Primarius IVS (Interactive Video System) all the capabilities of an on-line terminal.

No programming or computer knowledge is required. The self-paced lessons are designed to allow branching into areas of specific interest with constant feedback and reinforcement built in. Input is via a 12-key keyboard and an 8½x11 sensor panel for high resolution photographic overlays. Each IVS includes the console and a 12" color monitor.

Price is $1200. For details contact Primarius, Inc., 4186-J Sorrento Valley Blvd., San Diego, CA 92121.

CIRCLE INQUIRY NO. 355

MISCELLANEOUS

Light Pen for TRS-80

Esmark's VIDIET-STIK (Video Integrated Electronic Tracking) light pen is now available for Level I and Level II owners (4K to 48K). Plug the TRS-80's cassette EAR-plug into the interface, CLOAD the LIGHT-WAVE demonstration tape and RUN.

The pen's exclusive "switched-tip" design electrically isolates it from the system whenever it's not pressed against the screen.

The demonstration tape includes a calibration program (used to adjust the CTR's brightness and contrast) plus Stik-Tac-Toe, Awari and Towers.

For details contact Esmark, Inc., 507 E. McKinley Hwy., Mishawaka, IN 46544.

CIRCLE INQUIRY NO. 193

Video Display Glare Filters

Sun-Flex Company, Inc., manufactures a black nylon screen filter device for all varieties of CRTs on the market. The filters are a woven fabric held under tension on a plastic frame and are held in conformity to the tube by the fit of the bezel.

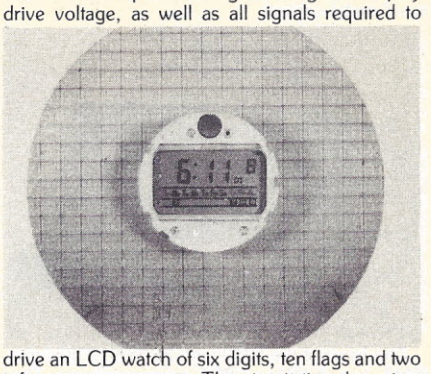
The filters provide greater contrast, resolution and reduce reflections while eliminating all glare.

Prices are $25 for a 15" CRT, $22.50 for 12" and $20 for a 9". For more information contact Sun-Flex Co., Inc., 3020 Kerner Blvd., San Rafael, CA 94901, (415) 456-8482.

CIRCLE INQUIRY NO. 356

Multifunction LCD Watch I.C.

Micro Power Systems offers the MP7216 HD/CMOS LCD multifunction watch circuit. It operates from a single 1.35V to 1.65V supply with an on-chip doubler generating the display drive voltage, as well as all signals required to



drive an LCD watch of six digits, ten flags and two information segments. The circuit time base is a 32,768 Hz crystal controlled oscillator.

For details contact Micro Power Systems, Inc., 3100 Alfred St., Santa Clara, CA 95050.

CIRCLE INQUIRY NO. 195

Cassette Duplication Service

Expansion Products Company offers custom cassette duplication service for suppliers of microcomputer programs.

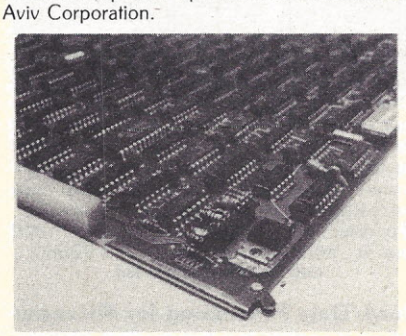
CERTI-TAPE duplicated cassettes are 100% certified for perfect data duplication accuracy. Every cassette is verified AFTER duplication is completed to insure that every program is data perfect, and therefore devoid of tape and data drop-outs.

For details contact Expansion Products Co., P.O. Box 4217, Mountain View, CA 94040.

CIRCLE INQUIRY NO. 196

Magnetic Tape Storage System

A high density magnetic tape storage system for NOVA/Eclipse computers that reads/writes in IBM compatible tape media is available from Aviv Corporation.



The GCR 6250 BPI Magnetic Tape System TFS-706 allows users to read or write in 1600 BPI phase-encoded or 6250 BPI GCR IBM-compatible tape media. Data integrity is insured by on-the-fly, 2-track error correction.

For details contact Aviv Corp., 6 Cummings Park, Woburn, MA 01801, Haim Brill.

CIRCLE INQUIRY NO. 197

Voice Plug-In

A single-board, high-accuracy, microprocessor-based Voice Recognition Module is supported by complete hardware and software development tools for OEMs.

The module adds voice input technology to intelligent terminals, small business systems, machine controllers and other computer products. Various VRM models are available with vocabulary capability for 40, 70 or 100 words, easily accommodating natural language discrete word inputs.

All the logic and input-output interfacing necessary to convert spoken words into computer codes are contained on the single circuit board, which is standard Multibus size.

For details contact Interstate Electronics Corp., 1001 E. Ball Rd., Anaheim, CA 92803.

CIRCLE INQUIRY NO. 198

Master Catalog System for CP/M

A Master Catalog system that can keep track of all the files on all the diskettes in use is available on a 'Scotch' brand single density diskette for CP/M users.

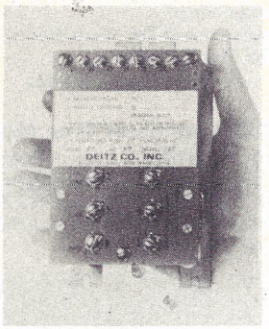
The system produces a listing of file names, in alphabetical order, with the name of the disk containing that file. Selective listings may also be made in a manner similar to that used by the CP/M 'DIR' command. The 'SUBMIT' command may be used to list the directories of selected diskettes.

For details contact Elliam Associates, 24000 Bessemer St., Woodland Hills, CA 91367.

CIRCLE INQUIRY NO. 199

Electronic Relay

The 411 Series electronic relays have been especially engineered to make use of add-on circuit boards which will enable the units to operate in power switching applications where the control source is an instrument, computer, photoelectric sensor or precision contact.



Compact in size and designed for use in a variety of control purposes, each electronic relay may also be accommodated, singly or in multiples, into standard electrical enclosures.

For details contact Deitz Co., Inc., Route 34, Wall, NJ 07719.

CIRCLE INQUIRY NO. 357

Multifrequency Receiver

Dual Tone Multifrequency Receiver series two DTMFR units are available for use in amateur repeater application or computer projects. The units will decode the standard telephone tone frequencies into a 2-out-of-8 code or binary format. The units are built on 4x8" circuit cards with a 22-pin card edge connector spaced 0.156 inches.

The unit features a single stage agc amplifier and a band splitter filter circuit that simplifies the filters usually found in receivers of this type.

The DTMF-CRC8030 uses the CRC8030 tone decoder while DTMF-MK5102 uses the MK5102 tone decoder.

For details contact O.C. Stafford Electronics S and D, 427 S. Benbow Rd., Greensboro, NC 27401, (919) 274-9917.

CIRCLE INQUIRY NO. 358

Apple Carrying Case

Computer Textile, Inc. has available a custom-designed Apple computer system carrying case. The case contains room for an Apple, 9" Sanyo monitor, two disk drives, power strip, two boxes of diskettes and manuals.

The case is finished in black vinyl with metal reinforced corners. The interior is completely lined with protective foam rubber covered with black velveteen for a professional appearance. The carrying case includes a built-in shelf over the Apple for the monitor and disk drives so the system may be operated in the case. For added convenience, it is not necessary to detach any cabling to pack the system for transport.

The case is designed suitcase style with the disk drives and monitor sitting beside the Apple. Size is 30" x 21½" x 10¾" and weight is about 12 pounds. For details contact Computer Textile, Inc., 10960 Wilshire Blvd., #1504, Los Angeles, CA 90024.

CIRCLE INQUIRY NO. 359

'Terminal Mates'™

Monarch Computer Products introduces the 'Terminal Mate' (U.S. patent pending). This terminal stand is designed to hold all sizes of data entry terminals. The design also means lower cost, instant delivery, easier assembly and versatility.

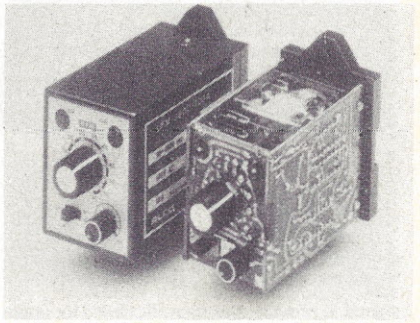
The unique interlocking system allows the units to be assembled in less than 60 seconds with no hand tools, nuts or bolts. As terminal sizes are changed, separate Terminal Mates tops can be order to accommodate the new size.

Terminal Mates tops come in 30", 36" or 45" width. For more information contact Monarch Computer Products, Inc., P.O. Box 4081, New Windsor, NY 12550.

CIRCLE INQUIRY NO. 361

Solid State 'ON' Delay Timer

Alco Delay Timers utilize state-of-the-art technology combined with time proven factors for unequalled performance, features and reliability. C/MOC IC circuitry joins a stable oscillator and a counter/storage arrangement for high repetitive accuracy and stability over a wide range of operating voltages and temperatures.



Standard UFM series operates on 115 VAC line and are stocked in three basic time ranges: 0.5-900 seconds, 0.5-1800 seconds and 1.0-3600 seconds.

For details contact Alco Electronic Products, Inc., 1551 Osgood St., N. Andover, MA 01845.

CIRCLE INQUIRY NO. 360

Apple Accessory

An attache style carrying case for the Apple computer is available from Computer Case Company. This case will hold the Apple computer along with a disk drive or tape recorder in a fully operational configuration. No need to disconnect and reconnect cables each time the computer is moved. Simply plug in the power cable and connect the monitor and operate.

The removable lid has storage space for manuals, disks, working papers, and other necessities. An elastic strap in the base provides handy storage space for disks or tapes. The computer and disk drive (or tape recorder) are held in position with security straps and cradled in foam rubber for protection when operating, transporting or storing.

For details contact Computer Case Co., 5650 Indian Mount Ct., Columbus, OH 43213.

CIRCLE INQUIRY NO. 363

CAI & Videotaped Teaching

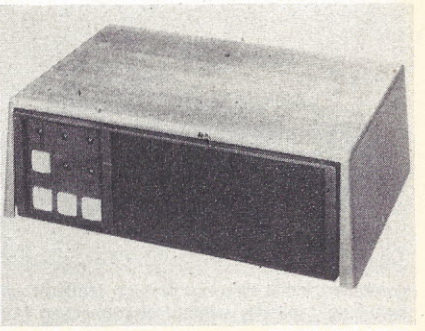
Computer Assisted Instruction (CAI) and Videotaped Teaching can be easily combined to give all the didactic power of CAI integrated with complex, moving, colorful visual materials plus speech, music and sound effects. Using the recently announced CAVRI System, CAI may be inserted into already existing videotapes.

A package consisting of all the materials required to integrate an Apple II and any video player/recorder having remote pause capabilities and two audio channels is available from Computer Assisted Video Recorded Instruction Systems, 26 Trumbull Street, New Haven, Connecticut 06511.

CIRCLE INQUIRY NO. 362

Disturbance Alarm System

The Safehouse RF Field Disturbance Alarm System, a motion detector by Radio Shack, protects an area of up to 50 ft. in length and up to 5,000 cubic ft. with an invisible beam of energy that detects motion.



The system is computer-controlled and the panel keyboard can be turned on or off with a 4-digit personal code only the owner knows. Also features a computerized sensor and high-power siren alarm amplifier.

For details contact Radio Shack, 1300 One Tandy Ctr., Ft. Worth, TX 76102.

CIRCLE INQUIRY NO. 194

MODEMS

Repertory Dialer

The REP repertory dialer for amateur repeaters is a circuit that stores phone numbers and passes them to a dialer circuit. The REP stores 100 phone numbers up to 20 digits long; retrieves 100 phone numbers with a 2-digit access code; is programmed from a remote location with a 4x4 tone pad and demux/sequence circuit and has built-in security. Only the control station can program the unit with phone numbers.

Other items needed for interface to the Buffington Control System are 1-Demux, 1-Sequence, 2-Row/Column Switches, 1-Signal Conditioner but not required.

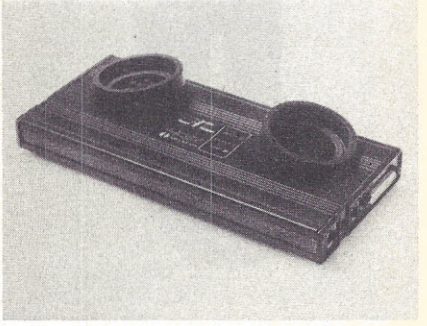
For details contact O.C. Stafford Electronics S & D, 427 S. Benbow Rd., Greensboro, NC 27401, (919) 274-9917.

CIRCLE INQUIRY NO. 300

Low-Profile Modem

An acoustic modem weighing only 1.5 lbs. and designed specifically for the personal and small computer market is available from Novation, Inc.

Called the CAT™, the 300 baud answer/originate EIA RS232C modem is engineered to transmit data over all telephone lines, is Bell 103 compatible and has an AC wall-mount transformer.



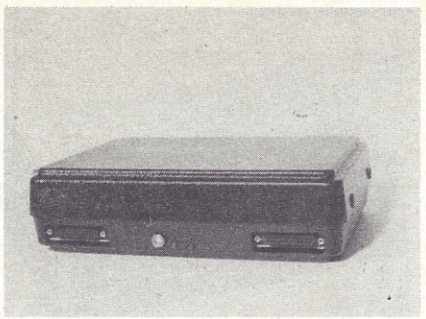
Features include switches for mode selection and operation, as well as LEDs for displaying unit status. Acoustic self-test is standard. The compact powerpack plugs directly into wall sockets. There are no dangerous voltages inside the CAT.

For details contact Novation, Inc., 18664 Oxnard St., Tarzana, CA 91356.

CIRCLE INQUIRY NO. 200

Programmable Switch

Via West, Inc. has introduced the Model PPS-2 Asynchronous Programmable Switch with transmission rates from 300 to 19200 baud. The PPS-2 was developed to allow access to two



computers either direct or through modems with switching capability without disconnecting from receiving device.

The PPS-2 allows file transfer from Computer A to Computer B with capability of monitoring data by Master Port.

For details contact Via West, Inc., 2739 W. Palm Lane, Phoenix, AZ 85009, Dave Troupe.

CIRCLE INQUIRY NO. 201

Datec 212

The Datec 212 provides full duplex transmission and reception of serial binary data at either 0-300 bps asynchronous or 1200 bps synchronous or asynchronous over the switched dial up network.

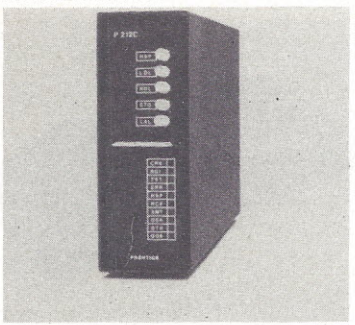
The Datec 212 is compatible with Bell 100 series and the new Bell 212A and any modem compatible with them. Four test buttons permit seven diagnostic tests of the entire communications network.

For details contact Datec Inc., 300 W. Main St., Carrboro, NC 27510, (919) 929-2135.

CIRCLE INQUIRY NO. 202

Dual-Speed Modems

Prentice Corporation offers the P-212A and P-212C, two dual-speed, dial-up data modems. Both units are improved versions of the Western Electric 212A data set.



The modems provide full-duplex transmission of 300 or 1200 bps serial binary data over two-wire dual-up lines. Automatic speed selection in the answer mode allows them to adjust their operation to match the transmission rate of the originating modem.

For details contact Prentice Corp., 795 San Antonio Rd., Palo Alto, CA 94303, Bill Myers.

CIRCLE INQUIRY NO. 204

Auto/Answer Modem

Terminal Systems announces the Model AAM-300 modem designed for two-wire direct connection to the phone system by means of a built-in FCC registered CBT (DAA) or hookup to an external CBT via a multi-wire cable.

The modem operates totally unattended in the automatic-answer mode, which means any incoming calls will be answered by the unit and automatically connected to the computer system.

When carrier is no longer detected, the modem will disconnect from the telephone line and at the same time signal the computer that carrier is no longer present.

For details contact Terminal Systems, 11300 Hartland St., N. Hollywood, CA 91605.

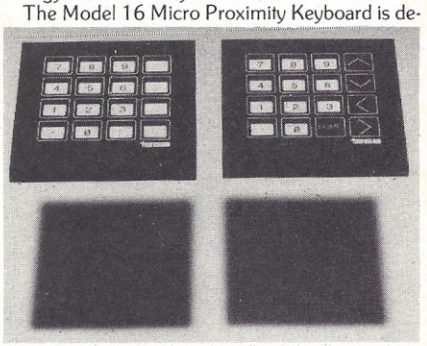
CIRCLE INQUIRY NO. 203

PERIPHERALS

4x4 Keyboards

A family of 16-position 4x4 keyboards which use solid state micro proximity touch sensor technology are offered by TASA.

The Model 16 Micro Proximity Keyboard is de-



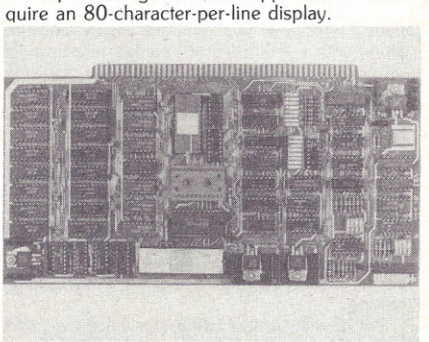
signed to provide maximum flexibility for applications requiring control of up to 16 different parameters or functions. Formats available include alphanumeric, numeric/cursor control and a hexadecimal version.

For details contact KML Marketing, Inc., 26740 Robleda Ct., Los Altos, CA 94022.

CIRCLE INQUIRY NO. 205

80x24 Video Board

The Model VB3 from SSM Microcomputer Products is an S-100 video interface designed for word processing and other applications that require an 80-character-per-line display.



The unit produces a standard 80x24 display, upper and lower case characters with descenders, up to 256 user-defined symbols, and a 160x204 graphics matrix.

For details contact SSM Microcomputer Products, 2116 Walsh Ave., Santa Clara, CA 95050.

CIRCLE INQUIRY NO. 206

STOCKEY™ Standard Keyboard

A line of general purpose encoded keyboards available off-the-shelf through electronic distributors has been introduced by Advanced Input Devices.

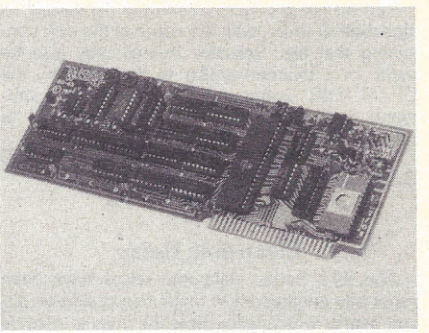
The Stockey Series offers ten general purpose standard keyboard designs, including six low profile models with ASCII encoded alphanumeric formats.

For details contact Advanced Input Devices, P.O. Box 1818, Coeur d'Alene, ID 83814.

CIRCLE INQUIRY NO. 210

Video Digitizer

The Micro Works DS-65 Digisector is a random access video digitizer produced for the Apple II. It converts a TV camera's output into digital information the Apple can process.



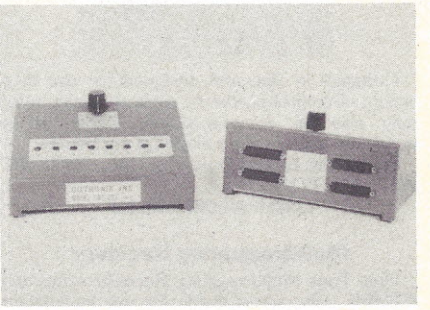
The Digisector features a high resolution 256x256 picture element scan, 64 levels of grey scale and accepts either interlaced (NTSC) or industrial video input.

For details contact The Micro Works, P.O. Box 1110, Del Mar, CA 92014.

CIRCLE INQUIRY NO. 207

RS232 Switch and Line Monitor

Giltronix Inc. is offering three models of switching and monitoring units consisting of the GRS 232-SM8, GRS 232-SM16 and GRS 232-SMC. Each unit has a standard RS232 line monitor and a 3-way switching unit.



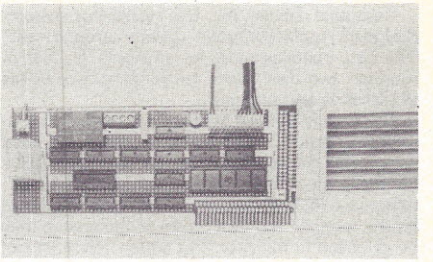
The line monitor section will monitor the RS232 interface signals while the 3-way switch will allow a variety of system configurations.

For details contact Giltronix, 3156 Avalon, Palo Alto, CA 94306.

CIRCLE INQUIRY NO. 208

Interface Boards

A peripheral interface board available from Vector Electronic Company is compatible with Apple II and Superkim+ microcomputers without any special adapter unit, and compatible with the PET Commodore unit with an adapter unit called Expandamem installed.



The Model 4609 is designed for construction of special control, communications, peripheral or memory interface circuits using semiconductor support devices.

For details contact Vector Electronic Co., 12460 Gladstone Ave., Sylmar, CA 91342.

CIRCLE INQUIRY NO. 209

Buffer Storage Units

A series of terminal storage units (TSU) featuring larger capacity and text editing functions is offered by Tri-Data for the Teletype Model 43 and Digital Equipment Corporation's LA/34 and LA/36 teleprinters.

The microprocessor-based TSUs deliver 4,000 and 16,000 characters, respectively, of semiconductor memory on single circuit boards designed for installation inside the printers' enclosure.

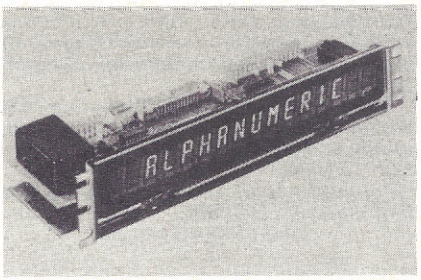
The units convert the Teletype and DEC printers into intelligent data entry work stations with send and receive text editing capabilities.

For details contact Tri-Data, 505 E. Middlefield Rd., Mountain View, CA 94043.

CIRCLE INQUIRY NO. 211

14-Segment Intelligent Displays

Alphanumeric display systems in 16 or 20 character panel size that are installed by plugging in data and power connections with no engineering time required are available from Cherry Electrical Products Corporation.



The systems are totally microprocessor controlled as self contained units complete with electronic circuitry including drivers, memories, buffered I/Os, DC input power supply and more.

For details contact Cherry Electrical Products Corp., 3600 Sunset Ave., Waukegan, IL 60085.

CIRCLE INQUIRY NO. 212

Interface Adapter

Com-plications, Inc. has developed an intelligent IEEE 488/Centronics interface adapter module Model Series C100 for the Commodore PET/CBM microcomputer series and other IEEE 488 controllers.

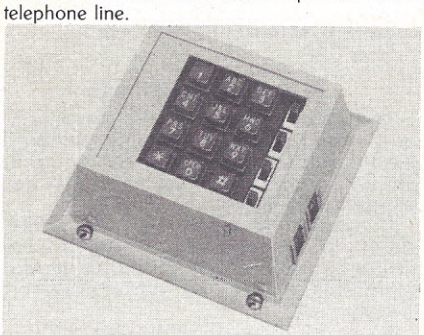
The adapter module allows printers using the Centronics interface to be attached to PET/CBM microcomputers or other IEEE 488 controllers using the built-in IEEE 488 interface.

For details contact Com-plications, 18 Adair Court, Danville, CA 94526.

CIRCLE INQUIRY NO. 213

Automatic Dialing Operation

A line of single number telephone dialers convert any telephone to which it is connected to automatic dialing operation. Called Unidialers, the small units in effect provide direct "hot-line" service without the need for an expensive leased telephone line.



When installed at on-line computer terminals, the operator merely lifts the handset or throws a switch and the Unidialer instantly dials the central computer.

For details contact Rath Western Corp., 2505 Foster Ave., Janesville, WI 53545.

CIRCLE INQUIRY NO. 215

Intelligent Printer

The HY-Q 1000™ is an intelligent printer designed for use with personal computers for business applications.

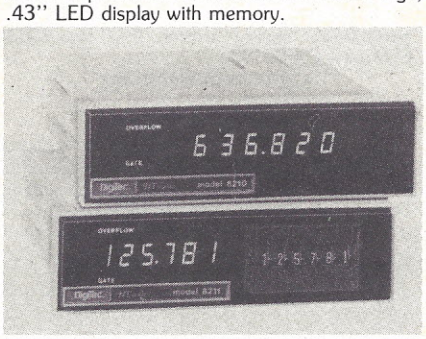
With its five built-in microprocessors, HY-Q 1000 — a low-cost, letter-quality daisy wheel printer — eliminates the need for complex personal computer software. Microcomputer owners can plug any personal (or other) computer into a HY-Q 1000, which will automatically convert simple codes into instructions for right justification, proportional spacing, automatic tabbing, bold and underlined letters, automatic columns, automatic title centering, automatic decimal point location, and other commonly-used text formatting functions.

For details contact Xymec, 17791H Sky Park Cir., Irvine, CA 92714.

CIRCLE INQUIRY NO. 214

Rate Monitors

United Systems Digilec Models 8210 and 8211 Programmable Computer Rate Monitors are microprocessor-based and have a full 6-digit, .43" LED display with memory.



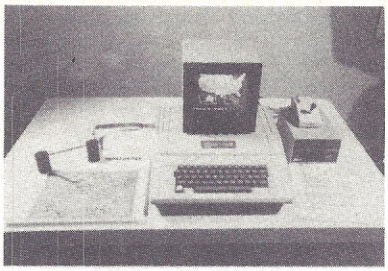
Designed to eliminate the long measurement delays associated with low input rates, these instruments achieve their speed, resolution and accuracy by counting the internal crystal clock during one or more periods of the input pulse rate.

For details contact United Systems Corp., 918 Woodley Rd., Dayton, OH 45403, Gary Day.

CIRCLE INQUIRY NO. 216

Graphics Drawing for Apple II

Rainbow Computing has available the VersaWriter, a digitizer and software drawing package for the Apple II Computer. The system provides high resolution, mass color graphics comparable to the quality of the Apple.



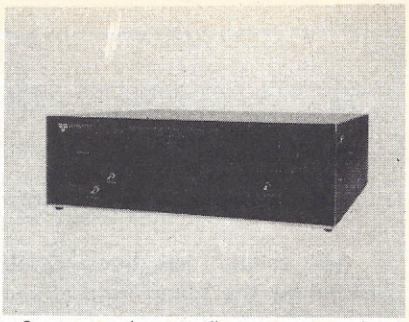
As a pointer the VersaWriter can direct movements of objects on the video screen, for game playing or creating graphics. As a digitizer, it provides a convenient means of inputting graphical data for analysis, flow charts and diagrams.

For details contact Rainbow Computing Inc., 9719 Reseda Blvd., Northridge, CA 91324.

CIRCLE INQUIRY NO. 364

Remote Plotting Controller

Emulating IBM 3780 data communications terminals, the Versatec Bysync Remote Plotting Controller (Model 440-20) provides remote electrostatic plotting and printing with any Versatec printer/plotter.



On request, the controller transmits pre-defined "signon" or inquiry card images to one or more host computers. The controller carries its own data-link trace facilities and self-test diagnostics.

For details contact Versatec, 2805 Bowers Ave., Santa Clara, CA 95051.

CIRCLE INQUIRY NO. 365

POWER SUPPLIES

Gimix Exports the Ghost

Gimix announces that it has available 50 Hz export versions of its chassis and 6800 systems. The 115/230 volt 50 Hz power supply uses a ferro-resonant constant voltage transformer.

It is identical in output to the Gimix 60 Hz model providing +8 volts at 25 amps and ±16 volts at 5 amps each, over input ranges of 90 to 240 volts, 50 Hz AC.

To insure reliability, systems are burned-in and tested using an in-house 50 Hz power system. The 50 Hz supply adds $30 to existing prices for chassis and systems.

For details contact Gimix Inc., 1337 W. 37th Pl., Chicago, IL 60609, Richard Don.

CIRCLE INQUIRY NO. 219

AC Power Controller

Marway Products has an AC Power Controller that is designed to be interchangeable with Digital Equipment's Model 861 and sell for less.

The Marway Products' MPD 115/230 AC Power Controller is used to distribute power effectively in computer systems, industrial control equipment and electronic test equipment. The unit features 12 output receptacles, four direct outlets for auxiliary and maintenance equipment and eight "switched" outlets.

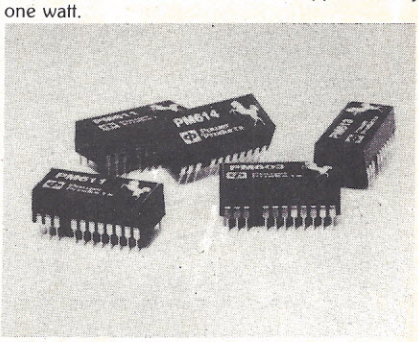
The device also has differential and common mode type EMI line filter to prevent electrical noise disruption of sensitive equipment.

For details contact Marway Products Co., 2421 Birch St., Santa Ana, CA 92707.

CIRCLE INQUIRY NO. 220

DC/DC Converters

The PM600 Series of low-power DC/DC converters feature the compact 24-pin dual-in-line package (DIP) pin configuration. Total power output in all PM600 series units is approximately one watt.



Designed for direct printed-circuit card mounting, PM600 Series DC/DC converters allow the design engineer greater leeway and flexibility in determining PC card component layouts.

For details contact Power Products Div., Computer Products, Inc., 1400 N.W. 70 St., Ft. Lauderdale, FL 33309.

CIRCLE INQUIRY NO. 366

MICRO-MARKET ADS SELL YOUR PRODUCTS

A new format has been established for the Micro-Market section. All ads are now 2 inches wide by 3 inches deep. Price is $200. Submit ads with check or money order to:

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Micro-Market Ads
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Cerritos, CA 90701

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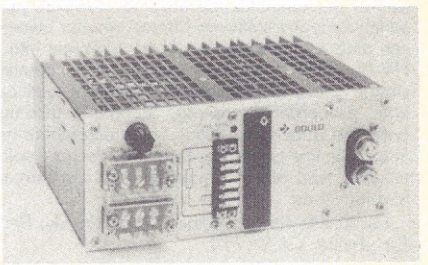
HORIZON-2-32K-D kit	2399	1905
Assembled & tested	2765	2195
HORIZON-2-32K kit QUAD	2799	2225
Assembled & tested	3215	2555
Pascal for North Star on Disk		49
Powerful North Star BASIC		FREE
TEI PT 212 Computer 5 MHz	8000	6250
Thinker Toys DISCUS 2/D, A&T	1149	949
Discus/2+2 1.2 megabytes, A&T	1549	1299
Measurement System Memory, A&T, 4MHz 64K		640
Godbout Memory		Call for Price
INTERTUBE II Smart Terminal	995	780
MICROTEK Printer	750	675
ANADEX Printer	995	875
Florida Data Printer, 600 cps, 4300		Call for Price
MARYELLEN Word Processor	Your Best Buy	38
Textwriter III		125
EZ-80 Tutorial, Learn Machine Language		25
PDS for North Star, Better than CP/M		99
Compiler for Horizon Secret Superfast Code		100
10• off software prices with computers		
VERBATIM the best Diskettes	Box of 10	29
Which Computers are best? BROCHURE. . . .		FREE
North Star documentation refundable w/HRZ		20

AMERICAN SQUARE COMPUTERS
Kivett Dr Jamestown, NC 27282 919-883-1105

Dual Input Power Supplies

Two dual input models of its MG5-60 and MG24-15 switching power supplies have been introduced by the Electronic Power Supply Division of Gould Inc.



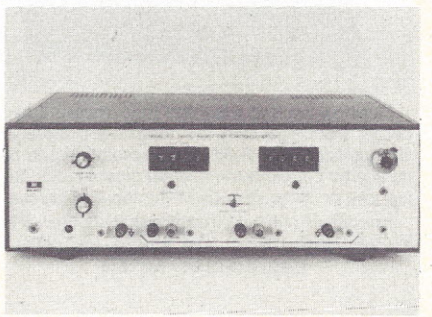
The MG5-60C and MG24-15C accept 110 or 220 volt inputs. Both models have a switch-on time of 600ms. Output voltage regulation is 0.1% maximum for a worst case combination of 100% load change and a ±10% line change.

For more information contact Gould/Electronic Power Supply Division, P.O. Box 6050, El Monte, CA 91731.

CIRCLE INQUIRY NO. 221

Dynamic Calibrator

Exact Electronics, Inc. has released a Digital Ramp/Step Function Generator. The Model 338 unit has both voltage and current source outputs. The voltage source output provides zero to 12 volts DC either positive or negative into a minimum load of 250 ohms. The current source output provides 4 to 20 milliamps DC into a maximum load of 2000 ohms or 10 to 50 milliamps DC into a maximum load of 800 ohms.

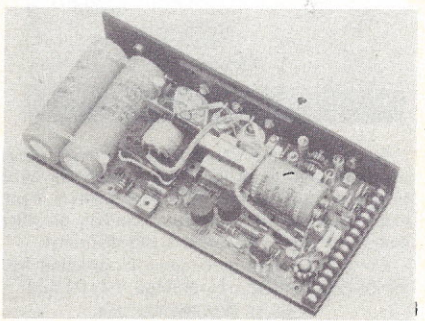


For details contact Exact Electronics, Inc., 6400 Signal St., Tillamook, OR 97141.

CIRCLE INQUIRY NO. 222

Switching Power Supply

RO Associates announces its latest 20 kHz switching power supply, producing four output voltages with a total power capability of 111 watts. The open frame design offers the reliability and performance of a modular type supply.



The Model 912 delivers 5 volts at 15 amps, ±12 volts at ±1.5 amps and −5 volts at .5 amps. Line regulation is ±0.1% on all outputs. The unit will accept 100/115/220.240 VAC inputs selectable on the barrier strip.

For details contact RO Associates, Inc., 246 Caspian Dr., Sunnyvale, CA 94088.

CIRCLE INQUIRY NO. 224

RS-232-C Wall Plates

Standard size wall outlet plates to accept RS-232-C connectors are being offered by Data Set Cable Company.

The plates have the same dimensions as single electrical box covers, are stamped with beveled edges, and can be had with one or two openings.

The D-15 adaptor can be used with Data Set's rack-mount 19" junction panels, which have 16 openings sized for RS-232-C connectors.

The plates and panels are fabricated in heavy-gauge aluminum, are supplied unfinished, or can be painted or anodized.

For more information contact Data Set Cable Co., 722 Danbury Rd., Ridgefield, CT 06877.

CIRCLE INQUIRY NO. 223

L Series Line Interrupters

A protective device from G T Industries prevents damage to electrical and electronic equipment by disconnecting power when the source goes out of specification in voltage or frequency.

The 7x3x3 line interrupter is connected between the power source and the protected equipment. A response delay avoids false triggers, and once tripped, the power remains interrupted until a button is pressed.

Trip points are internally adjustable to ±20%. Hardwired conduit and power cord models are available in 120 and 240 VAC single or 3-phase from 15A/1HP.

For details contact G T Industries, P.O. Box 912, Boulder, CO 90306.

CIRCLE INQUIRY NO. 225

Triple Output Power Supply

The Model 923 provides outputs of ±15 VDC at ±100mA and +5 VDC at 500mA, and operates from line voltages of 105 to 125 VAC, 50 to 400 Hz.

Designed to meet the needs of data acquisition systems, as well as A/D and D/A converters, the 923 is specified at ±0.02% maximum line regulation, and load regulation of ±0.02% maximum for the dual 15V outputs and ±0.05% maximum for the +5V logic power output.

For details contact Analog Devices, Route 1 Industrial Park, Norwood, MA 02062.

CIRCLE INQUIRY NO. 226

Military Comparators

The military version of a series of high speed dual voltage comparators that feature less than 12 nanoseconds propagation delay without sacrificing input performance characteristics has been announced by Signetics.

Designated the SE521/522 and SE521/883B, the series maintains a common mode voltage range of ±3 volts with a maximum input offset voltage of 7.5mV and an offset current of 5 microseconds.

To minimize delay, Schottky technology is employed at critical points in the circuit. The devices include TTL compatible output levels with a minimum sink/source capability of 10 Schottky gate loads. Typical operating frequency is 55 MHz.

For details contact Signetics, 811 E. Arques Ave., Sunnyvale, CA 94086.

CIRCLE INQUIRY NO. 227

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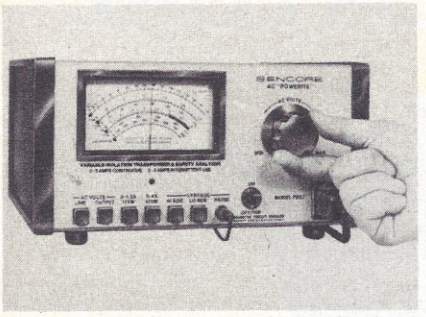
AC "Powerite"

The "Powerite" is a 400 watt isolation transformer to protect the technician, engineer or anyone in the vicinity against shock hazards from electronic devices during repair or even use.



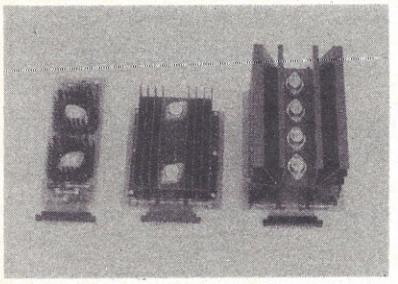
AC voltage is variable from 0 to 140 volts to sweat out intermittents, set the line voltage to 117 volts for accurate circuit measurements or to repair shut down circuits used in transformerless devices.

For details contact Sencore, 3200 Sencore Dr., Sioux Falls, SD 57107.

CIRCLE INQUIRY NO. 217

Audio/Servo Amplifier Modules

The PWR and SRV series of power amplifier modules cover a wide range of applications. The PWR50, PWR100 and PWR200 are 50, 100 and 200 watt (at 8 ohms) audio power modules built on a single printed circuit card.



External terminations have been reduced to only six connections via a PC edge connector. Features include integral heat sink, 4 Ohm minimum load, current limiting and 5Hz to 50KHz bandwidth.

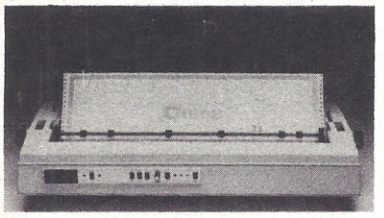
Prices range from $65 to $220. Contact Lintech Electronics, P.O. Box 25124, Albuquerque, NM 87125, (505) 281-1233.

CIRCLE INQUIRY NO. 370

PRINTERS

Intelligent Wide-Carriage Printer

An industry-standard RS-232C interface and internal programming allow the Sprint 5 Wide-Track printer to offer all of the capabilities of the popular Qume Sprint 5 RO (receive only) smart terminal.



Designed around a versatile microprocessor, the Sprint 5 printer offers ease of systems integration and equipment interface.

For details contact Qume Corp., 2350 Qume Dr., San Jose, CA 95150.

CIRCLE INQUIRY NO. 235

Dot-Matrix Impact Printer

The Model 7000+ is a high-speed, low-cost dot-matrix impact printer designed for small business and home computer systems. The unit features 1.25 lines per second uni-directional printing, with a line speed of 1.25 lines per second.

It accepts single- or multi-ply paper rolls from ¾ inch to 3⅞ inches wide, and prints a 3⅓ inch line. Capacity is 40 columns at 122 characters per inch.

For details contact LRC, Riverton, WY 82501. (307) 856-4821, Daniel Mitchell.

CIRCLE INQUIRY NO. 236

Quietwriter

Using a new typewriter technology, Centronics Quietwriter offers infinite electronic font flexibility, multi-copy capability, full-formed characters and silent operation.

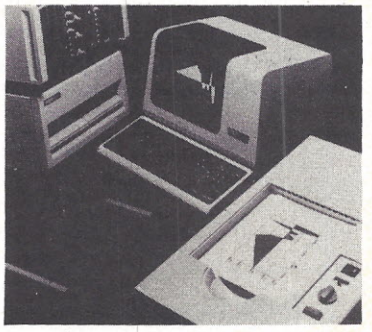
The Quietwriter prints in a manner similar to the human handwriting with a pen and can duplicate either script or standard typewriter characters. The flexibility of electronic manipulation of character sizes and styles is unlimited.

For details contact Centronics Data Computer Corp., Hudson, NJ 03051, Sterling Hager.

CIRCLE INQUIRY NO. 229

Desk Top Hard Copy Unit

The 4632 Option 8 Video Hard Copy Unit is specially designed for providing high resolution paper hard copies from DEC MINC systems: the MINC, the MiniMINC, and the VT105-based DECLAB-11/MNC.



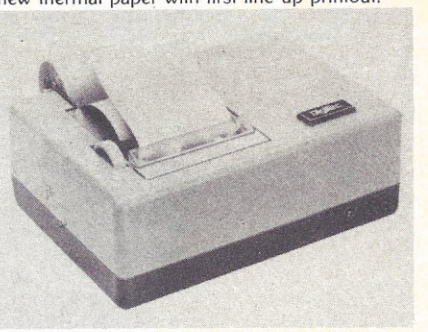
A circuit board replacement optimizes the appearance of hard copies made from MINC systems. The 4632 copies both alphanumerics and graphics simultaneously.

For details send letterhead request to Tektronix, Inc., Marketing Communications Dept., M.S. 63-635, P.O. Box 500, Beaverton, OR 97077.

CIRCLE INQUIRY NO. 230

Thermal Printers

The 6450 and 6460 alphanumeric Thermal Printers for both end users and OEM produce easy-to-read letters, numbers and symbols on new thermal paper with first line up printout.



The desk top units print 64 different characters with 21 characters per line and approximately 6500 lines per paper roll. The Model 6450 provides serial input and the Model 6460 is 8-bit parallel bus compatible.

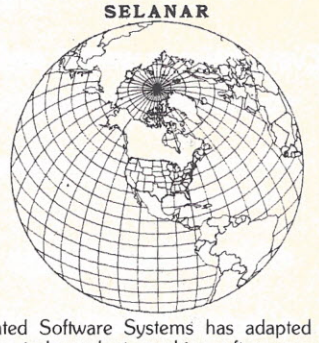
For details contact United Systems Corp., 918 Woodley Rd., Dayton, OH 45403.

CIRCLE INQUIRY NO. 231

DECwriter Graphics Available

Selanar announces operation of Graphics II with timeshare computers. Graphics II is a low cost modification to the DECwriter II for conversion to a plotter.

SELANAR



ISSPLA

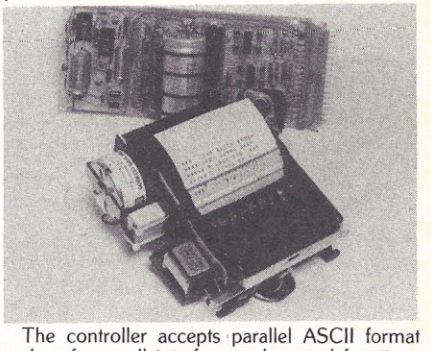
Integrated Software Systems has adapted their machine independent graphics software package DISSPLA and TELLAGRAF to run with Graphics II. All original attributes of the DECwriter are retained.

For details contact Selanar Corp., 2403 De La Cruz Blvd., Santa Clara, CA 95050.

CIRCLE INQUIRY NO. 232

Alphanumeric Printer System

The PR6024 printer controller and any Sodeco PR series print mechanism comprise an OEM print system operable from a single 12VDC power source.



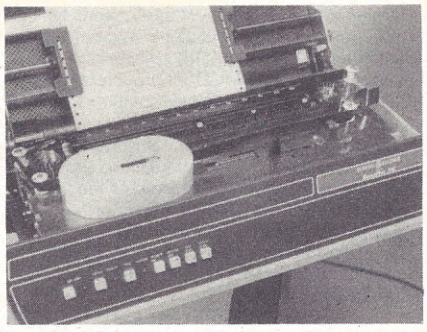
The controller accepts parallel ASCII format and performs all interface and control functions necesary to operate the PR series printers. The print mechanisms are Sodeco 15- or 21-column impact tape or ticket printers featuring a 54-character alphanumeric set, two-color snap-in ribbon cartridge and small size.

For details contact Print Products, Sodeco, Landis & Gyr, Inc., 4 Westchester Plaza, Elmsford, NY 10523, R.M. Banzaca, Sales Mgr.

CIRCLE INQUIRY NO. 233

Letter Quality Printer

The TermiNet 510 Corresponder by General Electric combines line printer speed with print quality to produce letter level clarity at speeds up to 340 lines per minute.



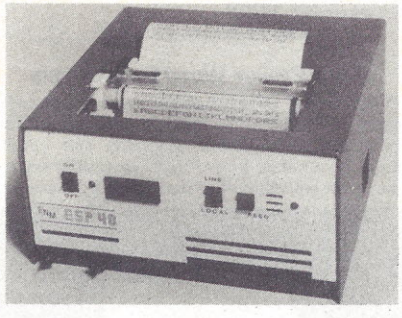
Enhanced with a multi-strike carbon-film ribbon cartridge that is operator replaceable, the unit uses a continuous carrier which will host most letterhead stocks.

For details contact General Electric Data Communication Products Business Dept., Waynesboro, VA 22980, (703) 949-1188.

CIRCLE INQUIRY NO. 371

Electrosensitive Matrix Printer

The ESP 40 features low power consumption, medium speed and silent operation. Because it can operate off a 12-volt system, it is suited to mobile applications for police, fire, utility and military users.



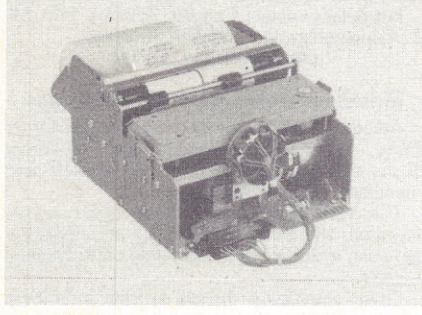
Capable of unattended operation and integration with computers, the ESP40 is a modular unit that can be built into a variety of test equipment.

For details contact Rank Numbering Machines, Inc., 411 E. Jarvis Ave., Des Plaines, IL 60018.

CIRCLE INQUIRY NO. 372

Low-Cost Receipt/Audit Printer

The Model M-420 is a dot-matrix impact printer with split paper feed for receipt/audit applications. The unit offers 3 lines per second bidirectional printing, 10 lps line feed, and prints two 18 character columns at 12 characters per inch.



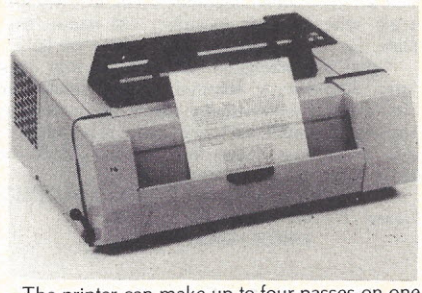
The M-420 features a printhead with a life of 100 million characters. The head, which consists of seven clapper type solenoids which activate the seven printwires, is designed for continuous service without overheating.

For details contact LRC, Riverton, WY 92501, (307) 856-4821, Richard Holmquist.

CIRCLE INQUIRY NO. 373

Letter Quality Dot-Matrix Printer

The Sanders Media 12/7 is a dot matrix printer capable of letter quality print due to its use of the Infinite Matrix Principle which allows precise control of dot placement.



The printer can make up to four passes on one line, offsetting dots by just a few mils. Print speed varies from up to 216 cps in one pass fonts to 59 cps in a four pass font.

For details contact Computer Textile, Inc., 10960 Wilshire Blvd., #1504, Los Angeles, CA 90024, (213) 477-3067.

CIRCLE INQUIRY NO. 374

900 Character Per Second Printing

The Model 600C offers 900 cps printing in a 15 pitch font, 600 cps printing in a 10 pitch font and includes the ability to select 6 or 8 line per inch formats. These features are selectable through software or panel switches.

The 900 cps print speed results in throughput capabilites which can outpace 600 lpm printers in applications such as inventory listings, general ledger print outs, program listings, etc.

For details contact Florida Data Corp., 3308 New Haven Ave., W. Melbourne, FL 32901.

CIRCLE INQUIRY NO. 375

SOFTWARE

Low Cost Disk Exerciser

DiskTool is a low cost software floppy disk exerciser and repair package targeted for microcomputer retail stores and technically minded individuals. DiskTool is currently available for Imsai IMDOS or CP/M systems using PerSci floppy disk drives.

It enables a technician to perform factory recommended adjustments on PerSci floppy disk drives including those made necessary when the main voice coil positioner lamp burns out.

For details contact Micro Systems Associates, Inc., P.O. Box 460, Morgantown, WV 26506.

CIRCLE INQUIRY NO. 257

Business/Financial Analysis Program

A complete business and financial analysis program announced by Microcomputer Applications, Inc. includes portfolio, home ownership, yield to maturity, ROI, economic order quantity, and twenty-eight other types of common business problems.

The package includes supporting utilities and 36 pages of documentation, including eight sample problems. It requires 10K and is available in TRS-80 Level II, CP/M or Kansas City.

Contact Microcomputer Applications, Inc., 4614 Trail Crest Cir., Austin, TX 78735.

CIRCLE INQUIRY NO. 252

NEW PETS* - OLD PETS*

NAIL* has programs for all of them. Whether your PET* is the original 8K, or the original 8K with an expanded memory, or the new 16K or 32K full keyboard machine, NAIL has programs for you. Here are the latest NAIL programs for the new 16K and 32K PETS with PET floppy disk units; SYS32000™ (for new 32K PET) SYS16000™ (for new 16K PET). These machine language Systems are available for immediate shipment on disk, tape, or PROM. Once loaded from tape or disk, the System remains resident and undisturbed until power is turned off. Immediately at your command are the following 22 functions:

(1). Load machine language program from disk. (2). Load machine language program from tape. (3). Save machine language program on disk. (4). Save machine language program on tape. (5). Dump BASIC program on tape for later appending. (6). Dump BASIC program on disk for later appending. (7). Append BASIC program from tape. (8). Append BASIC program from disk. (9). Renumber BASIC program with standard beginning line number and increment. (10). Renumber BASIC program with custom beginning line number and increment. (11). Display contents of registers. (12). Display memory. (13). Execute machine language program starting at address in program counter. (14.). Execute machine language program beginning at address given. (15). Exit to BASIC. (16). Compact BASIC program, removing all unnecessary spaces. (17). Eliminate from BASIC program range of line numbers given. (18). Display directory for disk drive #0. (19). Display directory for disk drive #1. (20). Trace execution of BASIC program. (21). Turn off Trace. (22). Help.

A NEW DIMENSION IN PROGRAMMING STYLE

By using the above Systems, you will develop a new and powerful programming style. For example, you can build up a library of powerful subroutines from your BASIC programs. Use the Eliminate function to remove all of the BASIC program except the subroutine you wish to isolate. Then, with the renumber function, you can give this subroutine a distinctive set of line numbers. Now, with the Dump command, you store this subroutine on your disk reserved for your library. Eventually you will have a large selection of subroutines from which to draw. Now, when you write a new BASIC program, you can simply drop in any of the subroutines from your library with the Append command. Use the Directory command to review your library on disk. Both the System and your BASIC program remain undisturbed as you review the contents of your disks. The subroutine can be placed anywhere you want it; at the beginning, at the end or any place in between. You do this by renumbering the BASIC program in the machine, and when the subroutine is Appended, it is automatically merged with the program already in the machine, with all line numbers in proper sequence. Now you can renumber the entire program, then Compact it to save memory, and then turn on Trace to watch it execute line by line with each line number shown on the screen as it executes.

SYS32000™ for the new 32K PET - SYS16000™ for the new 16K PET - $100 on disk or tape. $200 for PROM which plugs in to the PET ROM expansion socket.

For complete description of this and other programs, write for catalog #34

NAIL, Box F, Mobile, AL. 36601

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CIRCLE INQUIRY NO. 17

High Power to TRS-80 Mailers

Mail-Master offers the TRS-80 MOD I user the same power used by owners of large-scale mainframe systems.

Users can maintain up to 100,000 names and addresses in their mailing list data file, keeping files across diskette boundaries and allowing full-scale select options including last name, city, state, zip range, and a special select-code field.

Name and addresses can be up to four lines long, and can be selected, added, deleted or changed with built-in full dynamic space-packing routines. Standard file format allows easy interfacing of Mail-Master files to your own BASIC or other language programs.

For details contact Practical Applications, 1313 Laurel St., San Carlos, CA 94070.

CIRCLE INQUIRY NO. 251

Upgrade for Exidy Sorcerer

Exidy Data Systems has available a software package called the Development PAC, a plug-in ROM PAC cartridge that can turn the Exidy Sorcerer into a relatively sophisticated, cassette-based Z-80 development system.

The Development PAC includes four modules: a Designer's Debugging Tool (DDT), a line-oriented text editor, a relocating assembler and a linking loader. All can operate with the Sorcerer's dual cassette interface to allow tape-based system development, a factor contributing to the system's low cost.

Price is $99. For details contact Exidy Data Systems, 390 Java Ave., Sunnyvale, CA 94086.

CIRCLE INQUIRY NO. 250

TRS-80 Editor, Assembler, Debugger

Microsoft Consumer Products announces Editor/Assembler-Plus, an editing, assembling and debugging package available for the TRS-80.

Time-saving Assembler features include the ability to assemble directly into memory, conditional assembly and macro facility. The conditional assembly feature allows the assembly of code if a given condition is true. The macro facility saves programming time and memory space by defining macros to generate commonly used sequences of instructions.

For details contact Microsoft Consumer Products, 10800 N.E. 8th St., #819, Bellevue, WA 98004, (206) 454-1315, Vern Raburn, Pres.

CIRCLE INQUIRY NO. 237

Multitasking Operating System

polyFORTH is a real-time, multitasking operating system for the Intel SBC 86/12. A complete 8086 development system can be built around the SBC 86/12 by adding a terminal and a disk controller from the SBC series.

polyFORTH will manage these resources, providing all the needed facilities for 8086 program development. It integrates the FORTH language, a compiler, two interpreters, an assembler, an editor, virtual memory, and multitasking in one fully interactive package which resides in 8K of PROM.

For details contact Forth, Inc., 815 Manhattan Ave., Manhattan Beach, CA 90266.

CIRCLE INQUIRY NO. 179

GIGA Backgammon

GIGA Backgammon 1.0 for North Star users allows a player to compete against the computer at two levels, against another player, or the computer to play itself.

Output fits within a scrolling 16x64 character display with the board represented at the left and playing information at the right. Features include legal move evaluation, end game scoring and optional display of computer move evaluations.

Various playing options may be changed during play. Computer or player can double or generate dice rolls. Board positions can even be saved or created for replay.

Price is $15 for disk or $10 for listing. Contact Giga, P.O. Box 1881, Chicago, IL 60690.

CIRCLE INQUIRY NO. 255

Multi-User Development System

The Multi-User Development System (MUDS-11) for microprocessor software development on a wide range of industry standard 8- and 16-bit processors is available from International Data Services.

Designed for development applications typically requiring several stand-alone microprocessor development systems (MDS) or extensive use of timeshared facilities, MUDS-11 offers a cost effective hardware and software solution for users involved in software development.

Several programmers can perform program generation, assembly and simulation, simultaneously. Once programs are assembled they can be down-loaded to an on-line MDS or in-circuit emulator for final real-time emulation.

For details contact International Data Services, Inc., 453-D Ravendale Dr., Mountain View, CA 94043, (415) 969-7222.

CIRCLE INQUIRY NO. 254

Multivoice Music Software

Software support for the Newtech Model 6 Music Board is available on CP/M compatible disks. The MV80 Multivoice Music Interpreter allows the user to enter four-voice music in a simple notation.

The waveforms for each voice can be individually controlled to create the impression of a quartet made up of different instruments.

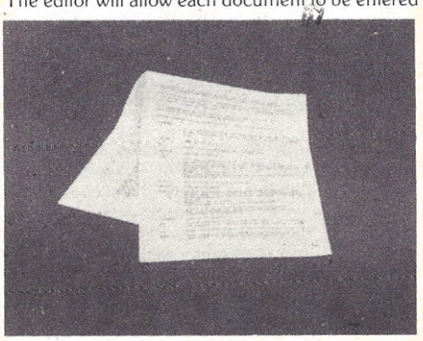
MV80 requires CBASIC2 and a 40K or larger 8080, Z-80 or 8085 CP/M system. It is available on 8" single density IBM, Micropolis Mod II and North Star 5" CP/M compatible disks.

For more information contact Newtech Computer Systems, Inc., 230 Clinton Street, Brooklyn, NY 11201.

CIRCLE INQUIRY NO. 253

High-Power Word Processing

WISDOM-II software allows users to build and search documents as large as sixteen million characters. WISDOM-II programs can handle single documents from 4,000 to 6,000 pages. The editor will allow each document to be entered



to the file size limits of DOS, RDOS, without the use of memory stored pages or manually read document segments. WISDOM-II will perform searches and/or search-replace for first occurrence or all occurrences of a letter, word or phrase.

For details contact Compac Systems, Inc., 59 E. Cunningham Dr., Palatine, IL 60067.

CIRCLE INQUIRY NO. 274

Business Software from Arkansas

Arkansas Systems, Inc. announces their Order Entry, Accounts Receivable and Inventory Systems, which are targeted at wholesale and manufacturing companies.

The Order Entry system writes invoices, adjusts inventory and charges the items to Accounts Receivable, which passes the activity on to General Ledger.

Order entry takes the bill to/ship to address from Accounts Receivable, taxable status, price to use and other information. As invoice line items are attached to the order, the description, price and other information is taken from Inventory.

For details contact Arkansas Systems, Inc., 8901 Kanis Rd., #206, Little Rock, AR 72205, (501) 227-8471.

CIRCLE INQUIRY NO. 275

3-Dimensional Simulation Program

3D-SIM is interfaced with a matrix high resolution board and the Apple II high resolution graphics and is used for extraordinary simulations. The user can fly and land a plane, travel through the Galaxy and visit high-rises.

It's real time animation in 3D. Available on CP/M disks at $115 and Apple II disks at $75. For details write PRS-The Program of the Month Corp., 257 Central Park West, New York, NY 10024.

CIRCLE INQUIRY NO. 276

Softronics APL for 8080/8085/Z-80

Softronics APL for the 8080/8085/Z-80 microprocessors is available. APL is an interactive general-purpose programming language with powerful primitive functions. Softronics APL has most of the functions and operators of full APL including n-dimensional inner and outer product, reduction, compression, general transpose, reversal, take, drop; execute and format; system functions and variables, system commands.

It runs under the CP/M operating system, residing in 30K bytes of memory and comes with an optional driver program for video display with programmable character generator.

For details contact Softronics, 36 Homestead Lane, Roosevelt, NJ 08555.

CIRCLE INQUIRY NO. 277

Vending Machine Software

Carolina Business Computers, Inc. announces its newest software system: MIRACLE ONE (Management of Inventory and Route ACcounting for Lowering Expenses). The system is designed for the vending machine business and is written to run on a low-cost microcomputer.

Program features include handling of route accounting transactions like machine inventory levels, metered sales, pulls, slugs, refunds, tests and over/short cash collections; period reports for sales tax; data entry via full screen masking, error checking and trapping, and batching of transaction entries.

For details contact Carolina Business Computers, Inc., Oakwood Center, 350 3rd Ave. NW, Hickory, NC 28601.

CIRCLE INQUIRY NO. 278

Foster Parent Remuneration Package

Resource Software International announces a package for State, City and County agencies charged with administration of foster child care. Written in COBOL, the system is ideal for maintaining all payment schedules for the reimbursement of foster parents.

The system provides for the identification of all expenses relating to foster child care. The two program package splits expenses into two categories, fixed and variable.

The fixed costs are based on age, sex, and location of child plus subdivisions into amounts for board, grooming and personal allowances. The variable costs cover such expenses as medical, summer camp, transportation, etc.

For details contact RSI, 140 Sylvan Ave., Englewood Cliffs, NJ 07632.

CIRCLE INQUIRY NO. 279

Payroll Software Package

Small business payroll software package from California Business Computers can handle full measure payroll activities for firms with up to eighty employees.

This software program has the new Earned Income Credit Provisions required in July 1980 plus federal and state tax tables for any state required preprogrammed into the software. Special city, county, or district tax deductions will be preprogrammed at no extra charge.

The program requires the CP/M disk operating system, C-BASIC or C-BASIC2 and is available on 8" single or double density and Micropolis Mod II 5¼" disks.

For details contact California Business Computers Corp., 825 W. Hamilton Ave., Campbell, CA 95008.

CIRCLE INQUIRY NO. 280

CPM for TRS-80 MOD II

A fully-CPM-compatible operating system for the Radio Shack TRS-80 MOD II computer has been announced by MPU. The operating system will work with CBASIC and all other CPM programs, requiring no changes to the operating codes. Source and object files will both work on the system, and programs from MPU and other CPM code-suppliers will be fully compatible.

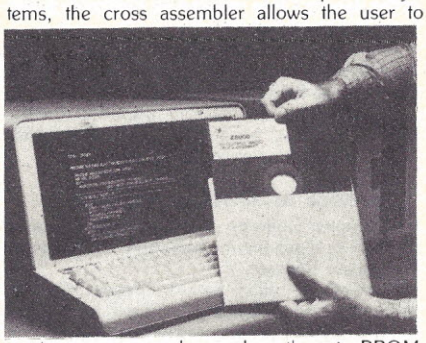
In addition, the complete Osborne Accounting package, Accounts Receivable and Payable, Payroll with Cost Accounting and General Ledger are also offered for MOD-I or MOD-II systems.

For details contact MPU, P.O. Box 808, San Carlos, CA 94070, (800) 824-7888.

CIRCLE INQUIRY NO. 281

Relocatable Cross Assembler

GenRad/Futuredata has a relocatable macro cross assembler for the Z-8000 microprocessor. Designed for use with GedRad/Futuredata 2300 series Universal Advanced Development Systems, the cross assembler allows the user to



create programs and reproduce them in PROM for execution on the target microprocessor.

Important parts of the programs are written in assembly language to optimize execution and memory usage.

For details contact GenRad/Futuredata, 6151 W. Century Blvd., #1124, Los Angeles, CA 90045.

CIRCLE INQUIRY NO. 258

DYNAMO for UNIX

Pugh-Roberts Associates announces Mini-DYNAMO for UNIX. Mini-DYNAMO is an interpreter for DYNAMO, a continuous simulation language. DYNAMO is used in a variety of applications including corporate, engineering, economic and social modeling.

DYNAMO aids in documenting models and producing output for presentation of results.

Mini-DYNAMO is now available in a version tailored to the UNIX operating system on the PDP-11 computer. The program is supplied on a UNIX compatible tape with load modules, command file and FORTRAN source.

For details contact Pugh-Roberts Associates, Inc., 5 Lee St., Cambridge, MA 02139.

CIRCLE INQUIRY NO. 259

Transaction Processor

The Harris Transaction Processor (HTP) is a proprietary software product designed for development, operation, management and maintenance of on-line transaction processing on Harris Computer Systems.

Features of HTP include interactive screen building, sign-on and security, menu processing, automatic editing, format and message scheduling.

In addition to terminal network management and database recovery, HTP automatically provides operating management with statistical reports useful for accounting, system tuning, operator guidance and measurement.

For details contact Harris Corp., Computer Systems Div., 2101 W. Cypress Creek Rd., Ft. Lauderdale, FL 33309, Manager, Marketing Communications.

CIRCLE INQUIRY NO. 260

ASCII encoded keyboards as low as $65.*

The RCA VP-601 keyboard has a 58 key typewriter format for alphanumeric entry. The VP-611 ($15 additional*) offers the same typewriter format plus an additional 16 key calculator type keypad.

Both keyboards feature modern flexible membrane key switches with contact life rated at greater than 5 million operations, plus two key rollover circuitry.

A finger positioning overlay combined with light positive activation key pressure gives good operator "feel", and an on-board tone generator gives aural key press feedback.

The unitized keyboard surface is spillproof and dustproof. This plus the high noise immunity of CMOS circuitry makes the VP-601 and VP-611 particularly suited for use in hostile environments.

The keyboards operate from a single 5-volt, DC power supply, and the buffered output is TTL compatible. For more information contact RCA Customer Service, New Holland Avenue, Lancaster, PA 17604.

RCA

Or call our toll-free number: 800-233-0094.

*Optional user price. Dealer and OEM prices available.

CIRCLE INQUIRY NO. 82

HAYDEN TAPES ARE NOT SOMEWHERE OVER THE RAINBOW...

SLOW LIST/STOP LIST (Gilder) Start, stop, and control the speed of your program with Apple II's game paddles. Control the speed at which the disk catalog appears and terminate CATALOG operation in the middle. The program can be enabled and disabled under software control. **#03904, Apple II, $10.95.**

REVIVE (Gilder) When a program is accidentally erased, REVIVE searches through memory and finds the information that enables it to restore the pointers that have been changed. Can be loaded at any time, even after you have accidentally erased the program. **#03604, Apple II, $19.95.**

SONGS IN THE KEY OF APPLE (Lopatin). Allows you to see and hear your favorite tunes, pre-programmed tunes, or music you create (up to 200 notes, including rests per musical piece). Multi-color graphics accompany all music. **#03304, Apple II, $10.95.**

APPLESOFT UTILITY PROGRAMS (Gilder) Contains 9 subroutines, among them 3 different statement formatters: REM, PRINT, and Poke writer. Other subroutines included are: calculating the decimal address of your machine language program, checking for illegal branches and indicating where one exists, joining two or more programs together, etc. **#03504, Apple II, $29.95.**

They're Down To Earth And At Your Local Computer Store!

Hayden Book Company, Inc.
50 Essex Street, Rochelle Park, NJ 07662

Property Management

A-T Enterprises has software to provide management and accounting control for income properties including apartments, condominiums, houses, mini-warehouses, mobile home parks, office buildings and shopping centers.

The software is designed to keep track of all income and expenses generating management statements and reports. The chart of accounts and profit and loss statement can be customized to closely duplicate the user's current method of doing business.

For details contact A-T Enterprises, 221 N. Lois St., La Habra, CA 90631.

CIRCLE INQUIRY NO. 266

Storage/Retrieval for TRS-DOS

ISAR (Information Storage and Retrieval) is a database management system designed to accommodate personal applications for persons desiring to use TRSDOS random file structures.

The system has a modular design which utilizes the TRS-80 'chaining' techniques. Only as much of the program is in memory as necessary to perform any given function.

The primary ISAR system consists of six modules. Each file or portion of a file can be sorted using BASIC Shell-Metzer sort.

For details contact The Alternate Source, 1806 Ada St., Lansing, MI 48910, (517) 487-3358.

CIRCLE INQUIRY NO. 267

Service to Software Developers

Computer Software Development Company announces a service for companies that develop proprietary software.

The service, called 'Software Product Packaging,' provides everything required to properly bring a software product to the marketplace. The service can be used by a company that is in any stage of the product development cycle. It applies to companies that have just started the design phase of their product, companies that have completed the technical development of their product and are ready to market it, and those that are already marketing a product and wish to upgrade its image.

For details contact CSD, 18057 Cotorro Rd., San Diego, CA 92128.

CIRCLE INQUIRY NO. 268

Text Processor for Apple

Charles Mann & Associates has released a text processor for the Apple II and Apple Plus computers called the Master Text Processor. The basic system includes its own mailing list element and a programmable form letter writer. The system will operate on 32K and either one or two disk drives.

The system allows continuous entry of text with automatic user defined formatting. Editing automatically adjusts lines in each paragraph to accommodate either longer or shorter text. Text may be merged under user control to format letters from stock sentences or phrases.

The powerful editing routine package includes change, insert and delete operations (including block deletions), text reformatting including sentence merger, string location and reporting and word or phrase replacement.

For details contact Charles Mann & Associates, Micro Software Div., 7594 San Remo Trail, Yucca Valley, CA 92284, (714) 365-9718.

CIRCLE INQUIRY NO. 269

8080/LSI-11 Text Processor

MANUSCRIPTER has been written in the Programmable Text Processor language, a new high level language specifically developed for text processing and currently being used in 8080 CPU and DEC LSI-11 systems.

MANUSCRIPTER is jointly released by CompuSystems of South Carolina and Jaars, Inc. The program is distributed with the PTP source listing for user modification.

For details contact CompuSystems of SC, Box 5144, Columbia, SC 29205, (803) 254-0804, Ramond Howell.

CIRCLE INQUIRY NO. 270

Five Software Packages

Compumax, Inc. has announced the extension of the availability of its time-proven generalized accounting software, General Ledger, A/P, A/R, Inventory Control and Payroll/Personnel, to a large variety of microcomputers. These five packages can be operated interactively or as standalone programs.

Packages are available for the TRS-80, PET, Apple II, CBASIC2 under CP/M, Cromemco System III, Micropolis BASIC and Microsoft under CP/M.

For details contact Compumax, Inc., 505 Hamilton Ave., Palo Alto, CA 94301, (415) 321-2881, Melinda Smith.

CIRCLE INQUIRY NO. 271

General Ledger for H8/H89

Users of Heath/Zenith H8 or H89 systems can now handle sophisticated general ledger accounting with General Ledger II, a new program package available from Clark Systems Corporation. The package provides for user definition of the chart of accounts, including names of accounts and their numbering scheme; also the names of headings, subtotals, and totals for the statements.

Package includes program diskette and complete user's manual. Requires Microsoft BASIC. For details contact Clark Systems Corp., P.O. Box 490156, Atlanta, GA 30349.

CIRCLE INQUIRY NO. 272

MICROBOL-Based Payroll Package

This system runs without modification on a very wide range of machines. It is simple to operate and provides comprehensive management reports.

Both weekly and monthly payrolls are supported and the pay frequency can be any divisor of 52 weeks or 12 months respectively. A single payroll run can be made to cover several consecutive pay periods, either for all employees or for selected employees.

For details contact CAP-CPP MicroProducts, Bldg. 0, 1101 State Rd., Princeton, NJ 08540.

CIRCLE INQUIRY NO. 273

LISP for CP/M

LISP is now available for CP/M users on an 8" floppy disk. LISP/80 is a full implementation of LISP 1.5 with upward compatible extensions such as strings and pattern matching functions.

LISP/80 has full CP/M I/O and functions for loading and saving disk files. TRACE debugging and editing of console input are also provided. LISP/80 has a fast, sophisticated garbage collector. LISP is the primary language of Artificial Intelligence research.

LISP offers pattern matching and recognition, robot simulation, game playing programming, general problem solving, natural language processing and much more.

Price is $75 including user's manual. For details contact T.W. Yonkman, 4182 Caminito Islay, San Diego, CA 92122.

CIRCLE INQUIRY NO. 138

PRO-TYPE on CP/M Disk

PRO-TYPE, available on CP/M-compatible 8" single density disk, features text editing and formatted printing in a single, compact program (requires only 8K of memory). This permits interactive feedback of the results of editing, without any delay required to load a separate text formatter.

The formatted text can be displayed on a CRT screen in exactly the same way that it will be printed on paper. PRO-TYPE is completely compatible with any kind of input terminal.

PRO-TYPE is available on 8" CP/M disk, North Star disk or Meca Alpha Tape for $75 including the 72-page manual. $25 for manual only. For more information contact Interactive Microware, Inc., P.O. Box 771, State College, PA 16801, (814) 238-8294.

CIRCLE INQUIRY NO. 134

Statistics Program

This three disk series is especially useful for engineering applications. These diskettes are entitled STATISTICS I, STATISTICS II and STATISTICS III. Each disk contains five separate programs stored on a "soft disk" and comes complete with documentation.

Common to all three packages is a file manager program that generates, maintains and displays files for use by other programs.

The programs are available through all Compucolor distributors. For details contact The Rainbow Tree Corp., 923 S. Omni International, Atlanta, GA 30303, (404) 523-0030.

CIRCLE INQUIRY NO. 239

Multi-User Operating System

Utilizing optimized Z-80 code, the OASIS multi-user operating system runs on most popular Z-80 microcomputers. The program features ISAM files, hard and floppy disk support, editor, user accounting with logon, password, privilege level and file security.

Options include OASIS BASIC Compiler, Pascal, COBOL, FORTRAN, text editor and output processor, macro assembler, debugger, linking loader and more.

For details contact Phase One Systems, Inc., 7700 Edgewater Dr., #830, Oakland, CA 94621, (415) 562-8085.

CIRCLE INQUIRY NO. 238

Universal Data Entry System

The Universal Data Entry System (ENTRY) provides an easy to implement way to increase operator efficiency and accuracy in data entry. The ENTRY System is made up of two programs: UDEGEN and ENTRY.

The interactive UDEGEN program generates the custom key-to-disk modules which are stored as data files to be used with the ENTRY program for actual data entry. The UDEGEN program can also be used to revise a previously defined data entry module.

The sequence of entering the data, the CRT headings and labels and the number of records displayed are defined in UDEGEN. Validation procedures such as check digits, tabled value tests, range tests, batch totals and record counts are provided to improve data quality.

Price is $195. For details contact the Software Store, Ltd., 706 Chippewa Sq., Marquette, MI 49855, (906) 228-7622.

CIRCLE INQUIRY NO. 240

CP/M on Altair Disk

With the arrival of the CP/M operating system for the Altair disk, users may take full advantage of the wealth of software generally available without equipment changes of any kind.

The Lifeboat implementation on the Altair and MITS 3202 series of floppy disk systems takes full advantage of the 300K plus capacity per disk and the good error free characteristics of the equipment.

Languages such as C, COBOL, FORTRAN, Pascal, and BASIC are immediately available, as are applications from word processing to accounting.

For details contact Lifeboat Associates, 2248 Broadway, New York, NY 10024.

CIRCLE INQUIRY NO. 241

Dungeons and Dragons

DUNGEON #1, the first in a series of solo Dungeon and Dragon style adventures, has been released by Chameleon Software Inc. In each adventure a character is created, equipped with weapons and armor of her/his choice and sent into the Dungeon in search of fame and fortune.

Special commands include acquiring and leaving behind items, asking for help, and instructing that the current game be saved onto a storage diskette for resumption at a later time.

For details contact Chameleon Software Inc., 4733 N. Mitchner, Indianapolis, IN 46226.

CIRCLE INQUIRY NO. 256

Micro-Ap General Ledger

Micro-Ap is offering GLector, a general ledger system to run with their Selector III-C2 Information Management System. The GL uses transaction codes for data entry which removes the need to memorize account numbers and whether credits or debits are to be applied.

GLector manages 24 months of data and allows any account balance for any month of the current fiscal year to be instantly updated. Prior month account balances are easily entered with GLector automatically computing asset, liability, capital, revenue and expense subtotals and totals.

Requires 52K CP/M compatible operating system, CBASIC Version 2 and Selector III-C2. For details contact Micro-Ap, 9807 Davona Dr., San Ramon, CA 94583, (415) 828-6697.

CIRCLE INQUIRY NO. 242

Operating System for Z-80

The OMNIX operating system for Z-80-based microcomputers implements and extends the capabilities of the popular UNIX operating system.

Users communicate with OMNIX via the shell, a command-line interpreter which accepts input from the user's console or from a file. Since shell commands include control statements like WHENEVER, IF-ELSE and WHILE, with a macro substitution and wild-card facility, the shell itself may be programmed in what amounts to a structured macro language.

OMNIX runs in an address space of at least 64K bytes and is available in load-and-go versions for Industrial Micro Systems and Cromemco System 3 microcomputers. A conversion utility is provided to transfer programs and files from CP/M to OMNIX, where they can be run without recompiling or relinking.

For more information contact Yourdon Software Products Group, 1133 Avenue of the Americas, New York, NY 10036.

CIRCLE INQUIRY NO. 249

DATA TERMINAL EQUIPMENT — FROM MICROMAIL

LA34 DECwriter IV

$999.00

- Upper/lower case, 9x7 dot matrix
- 10, 12, 13.2, 16.5 characters/inch
- 2, 3, 4, 6, 8 or 12 lines/inch
- 22"W x 7"H x 15½"D, 25 lbs.
- 110 or 300 baud, RS 232C serial ASCII
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New from DIABLO

DIABLO 1640 $2,920.00
Receive-only $2,525.00
High-quality daisywheel printing at 45 cps.

DIABLO 1650 $3,070.00
Receive-only $2,675.00
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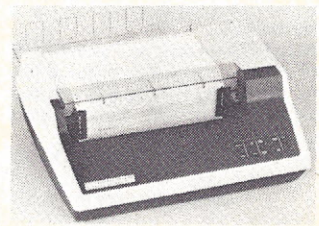
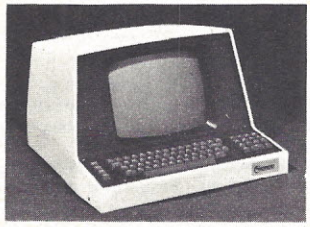
T.I. 810 printer $1,599.00

- Includes upper/lower case
- 150 characters per second
- RS 232C serial interface
- Adjustable forms tractor



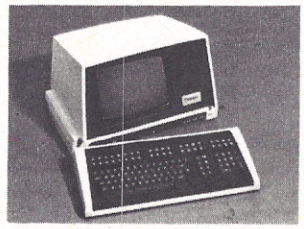
SOROC IQ 120 $740.00

- RS 232C, upper/lower case, full ASCII
- Numeric keypad, protected fields
- Cursor keys plus addressable cursor
- Auxiliary extension port



SOROC IQ 140 $1,130.00

- RS 232C and 20mA current loop
- Extensive editing features
- 25th line terminal status display
- 16 function keys (32 with shift)



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*Handling: Less than $2,000, add 2%; over $2,000, add 1%. Everything shipped freight collect in factory cartons with manufacturer's warranty.

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Smoke Signal Applications Software

Three software packages, designed to extend the range of applications for the Chieftain small business comptuer system are available from Smoke Signal Broadcasting.

The new Payroll Processing, Inventory Control/Order Entry and Accounts Receivable/ Invoice Entry systems run under SSB's Random DOS on a 48K byte, 6800 microprocessor with a minimum of 360,000 bytes of disk storage.

Common features include direct on-line updating and inquiry of selected items and instantaneous status reporting of data.

For details contact Smoke Signal Broadcasting, 31336 Via Colinas, Westlake Village, CA 91361, (213) 889-9340, Jim Allday.

CIRCLE INQUIRY NO. 248

Software Medical Package

A computer software medical package, written and tested by medical professionals, is available from Graham-Dorian Software Systems, Inc.

The package handles all details of billing insurance forms, treatment records, and many reports including charge and payment entry, patient statements, Blue Cross billing, Medicare submittals, Medicaid remittances, commercial insurance billing, collection accounting and dunning, patient processing, numeric or alphabetic patient listing, CPT-4 procedure and ICDA-9 diagnostic code reports, aged accounts receivables, third party accounting and reconciliation, and transaction reporting.

The package can be ordered on standard 8" disk or various minifloppy disks. Each package includes the software program in INT and BAS file form plus a user's manual and hard copy source listing for easy customizing.

For more information contact Graham-Dorian Software Systems, Inc., 211 North Broadway, Wichita, KS 67202.

CIRCLE INQUIRY NO. 245

Multi-Terminal SDOS

Software Dynamics announces release of a multi-terminal configuration for SDOS, its 6800/6809 disk operating system. The multi-terminal option allows up to eight users to simultaneously execute and/or develop application programs. Each user can have from 16 to 48K bytes, controlled by bank select or memory mapping. All the standard facilities of SDOS are supported, including overlapped, interrupt-driven device independent I/O, simultaneous floppy and hard disk management of up to 2 billion bytes per disk.

New facilities provided include CRT-independent cursor control/data entry/display. Applications can be built using SD's Business BASIC Version 1.4 compiler. Other support includes text editor and assembler.

For details contact Software Dynamics, 2111 W. Crescent, Suite G, Anaheim, CA 92801.

CIRCLE INQUIRY NO. 246

Apple Software Collection

Apple Barrel Bushel #1 is a collection of 25 programs that has something to offer the Apple user. Program titles include Mortgage Loan, Days Between Dates, Calendar, Savings, Checkbook, Addition, Subtraction, Multiplication, Division, Metric Conversion, Luna C, T or L, Apple LeMans, Alien, Think, Mountain, Black Hole Chase, Demolition Derby, Pacifier, Shape Builder, Plot, Menu Utility, Screen Print and Music Utility.

The package is available on cassette for $24.95 or disk for $29.95. For details contact Computer Data Systems Corp., 550 N. Main St., Logan, UT 84321, (801) 753-6990.

CIRCLE INQUIRY NO. 247

Checkers and Backgammon

Two new software packages for personal computers — Checker King and Gammon Gambler — are offered by Personal Software, Inc. Each program turns an Apple II, Commodore PET and CBM, or Radio Shack TRS-80 personal computer into a challenging board game opponent.

Both programs were created using "artificial intelligence" programming techniques that developed the programs' skill and speed. Checker King's program was written in machine language, and Gammon Gambler's was written in both machine language and BASIC.

For details contact Personal Software, Inc., 592 Weddell Dr., Sunnyvale, CA 94086.

CIRCLE INQUIRY NO. 243

Utility Programs

The Machine Language Utility Pac is a powerful package of utility programs designed for the PET computer. The package includes an extended Monitor, a disassembler, HEX/decimal conversion, screen dump onto a printer, machine code relocate, and a tape relocate.

Also included are two extra programs, Renumber and Merge, which are to be used with BASIC programs.

The Utility Pac comes with a combination of a basic and machine code program designed to relocate the Utility Pac to any location in memory. The Utility Pac can be used with most any amount of memory.

For details contact P.S. Software House, P.O. Box 966, Mishawaka, IL 46544.

CIRCLE INQUIRY NO. 376

High-Speed Sort Utility

BPS has a version of BPSort, a high-speed, machine language code sort/merge utility for Ohio Scientific floppy and hard disk systems. Unlike other OS-65U sort products, BPSort is written in assembly language for fast operation. Twenty thousand bytes can be sorted in 10 seconds.

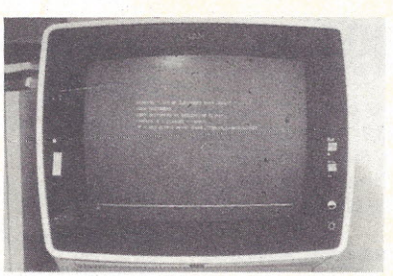
Files can be up to an entire hard or floppy disk in length. BPSort handles fixed-length records. Five keys can be specified for ascending and/or descending sequence.

For details contact BPS, 322 W. 57th St., New York, NY 10019, (212) 765-0815.

CIRCLE INQUIRY NO. 377

Query Language for IBM OS/DOS

Azrex AZ7 is an inquiry software system for IBM OS/DOS users that lets programmers and non-programmers manage data, retrieve information, process queries, and generate reports by using simple English-like commands.



Reducing report implementation time and programming costs, the flexible, free-format language adapts easily to a variety of reports, including personnel, finance and inventory control.

For details contact Azrex, Inc., 3 Mountain Rd., Burlington, MA 01803, (617) 272-8750, Bob Randolph, Vice President/ Marketing.

CIRCLE INQUIRY NO. 378

Apartment Management System

National Software Marketing Inc. has released an apartment and rental unit management system for the Radio Shack computer system. The system is designed to operate with tape or disk systems with or without a printer.

The user can randomly access any unit, scroll through all units, and modify and update all files. The package produces delinquency, lease expiration and maintenance reports, rentroll with last rent paid, security deposit, and annualized rent; and listing of tenants with children and pets.

The tenant file contains all necessary data including comments and maintenance record. The system can accommodate multiple units.

For details contact NSM, Box 6195, Hollywood, FL 33021, (305) 961-4888.

CIRCLE INQUIRY NO. 379

Logical Dump/Restore Utility

FAVER (Fast-Virtual-Export-Restore) is a high-performance dump/restore utility designed expressly for VSAM files.

FAVER allows clusters to be exported (dumped) or restored by catalog, volume, or individually. Control cards are simplified and virtually no job control language is required for operation.

The export program maintains pertinent catalog information on the back-up tape, allowing the restore to be totally automatic, with FAVER handling all delete/define operations. Extensive VSAM structure testing is incorporated to identify damaged clusters.

For details contact Goal Systems Corp., P.O. Box 29481, Columbus, OH 43229, (614) 268-1775, J. Michael Orthmeyer.

CIRCLE INQUIRY NO. 380

Statistical Package

Ecosoft has released an advanced statistical package called MICROSTAT designed for serious scientific, research and business applications. MICROSTAT uses special algorithms designed to minimize errors introduced into many statistical calculations when large numbers are used.

MICROSTAT utilizes a Data Management Subsystem to control, edit and modify all files that are used as data input into the system. Among other functions, DMS permits up to 11 data transformations on any date file, including reciprocals, exponential and linear transformations, plus the ability to augment, rank order, sort and lag variables in the data file.

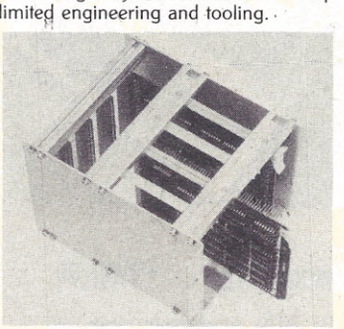
For details contact Ecosoft, P.O. Box 68602, Indianapolis, IN 46260, (317) 253-6828.

CIRCLE INQUIRY NO. 381

SUPPLIES

File Card System

Scanbe's "Snap" file card mounting system consists of two basic parts — snap-in guides and punched, fixed-space mounting bars. Lead time and costs are greatly reduced as the file requires only limited engineering and tooling.



Guides are molded of high-grade nylon that is self-lubricating, non-conductive and provides excellent isolation for cards and components from shock and vibration.

For details contact Scanbe, 3445 Fletcher Ave., El Monte, CA 91731, (213) 579-2300.

CIRCLE INQUIRY NO. 282

Anti-Static Spray

A Computer Room Anti-Static Spray from Misco is specially formulated to remove harmful static charges from computer room equipment and discourages static buildup.

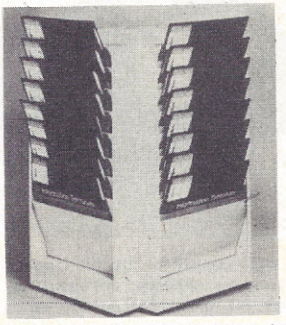
Non-corrosive, non-toxic and non-flammable, the Anti-Static Spray may be applied directly to furniture, floors, carpets, and sprayed around computers and peripheral equipment. The product is quick drying; will not spot or stain.

Non-aerosol 16 oz. plastic spray bottle, $4.95 each; 3 or more $4.75 each. For details contact Misco Inc., 963 Holmdel Rd., Box 399, Holmdel, NJ 07733, (201) 946-3500, Pat Michels.

CIRCLE INQUIRY NO. 283

Diskette Storage/Retrieval System

A four-sided revolving diskette storage and retrieval stand that gives fingertip access to up to 64 standard 8" square or 48 mini 5¼" square diskettes, is available from Computer Resources.



The welded steel constructed unit revolves on a felt padded ball bearing base.

For details contact Computer Resources Co., 2 Penn Plaza, #1500, New York, NY 10001.

CIRCLE INQUIRY NO. 284

Subminiature/Microminiature Lamps

A full line of incandescent lamps ranging from T ⅜ to T 1¾ sizes and from 0.130 to 0.625 inches in overall length are available from Oak Technology Inc. Line filament designs are also offered ranging from T ¾ to T 1¼ sizes and 1.30 to 13.1 inches in overall length.

Options include supported or unsupported filament coils, lens tips or smooth "tipless" construction for undistorted end viewing, and clear or color-coated glass envelopes.

For details contact Oak Switch Div., Crystal Lake, IL 60014, (815) 459-5000, Nancy Towe.

CIRCLE INQUIRY NO. 285

Flat Cable Connector

Augat Inc. has a selective grounding (SG Series) flat-cable IDC connector assembly and header system that doubles the number of I/O signal connections with the same PC board real estate as a conventional signal header-connector pair. Its design allows any combination of signal-ground assignments.

Use of the SG connector can eliminate the need for paddle boards, lower the cost of circuit boards and reduce space requirements of both cable runs and board mounted mating headers.

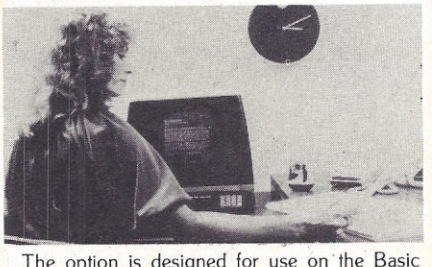
For details contact Augat Inc., Interconnection Components Div., 33 Perry Ave., Box 779, Attleboro, MA 02703, G.V. Harkins.

CIRCLE INQUIRY NO. 286

TERMINALS

Full Page Terminal for DP/WP

Basic Four Corporation offers DataWord II, a system featuring a full page, 15-inch multi-functional terminal that can be used for both word processing and data processing.



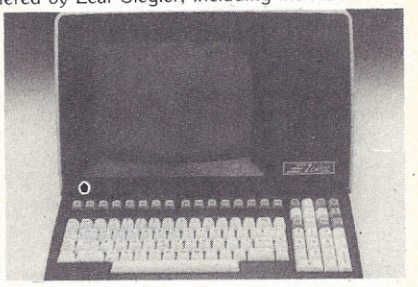
The option is designed for use on the Basic Four System 410 and enables the user to perform both functions concurrently, using the same database. The terminal also features a 10-key numeric pad for rapid data entry.

For details contact Basic Four Corp., P.O. Box C-11921, Santa Ana, CA 92711, Anne Prine.

CIRCLE INQUIRY NO. 177

Zentec Smart Terminal

The Zephyr Series is Zentec Corporation's first entry into the smart terminal marketplace and is compatible with such alphanumeric terminals offered by Lear Siegler, including the ADM-31.



The Zephyr is a microprocessor-based video display terminal that offers a wide range of intelligent features including full cursor addressability, full editing and protected forms mode.

For details contact Zentec Corp., 2400 Walsh Ave., Santa Clara, CA 95050.

CIRCLE INQUIRY NO. 288

'Tubeless Terminals'

Synertek Systems has used L.S.I. design to implement all the digital logic of a smart terminal on a single PC board with full ASCII keyboard. This concept reduces the PC board real estate to the point where the video display logic is placed on the same board space that would be used by the keyswitches and encoding logic alone.

All the Tubeless Terminals are provided assembled, tested and warranted. For details contact Synertek Systems Corp., 150 S. Wolfe Rd., Sunnyvale, CA 94086.

CIRCLE INQUIRY NO. 289

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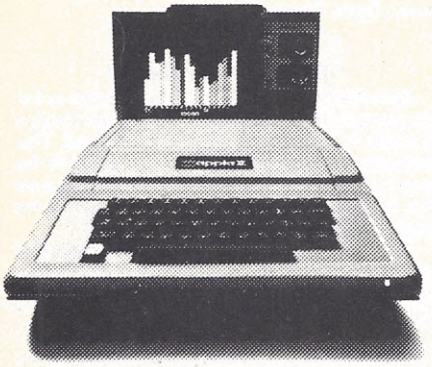
CIRCLE INQUIRY NO. 116

apple computer
Sales and Service



FEBRUARY SPECIALS
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Save $325.00 on a 48k Apple Computer system, disk drive, RF modulator and DAN PAYMAR lower case adapter.

Apple Computer system with 48k upgrade	$1295.00
Apple disk drive w/controller	$ 550.00
DAN PAYMAR lower case adapter. (A $50.00 value)	N/C
SUP-R-MOD TV RF Modulator.... (A $30.00 value)	N/C
TOTAL SYSTEM PRICE	$1845.00

- Price includes 24 hr. burn in
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- One (1) year guarantee on lower case adapter

NEW APPLE SOFTWARE
NOW IN STOCK

Programma Tiny Pascal	$49.95
Programma Master Catalog	$29.95
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Applecations Text Editor	$60.00
Applecations Form Letter	$29.95
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CIRCLE INQUIRY NO. 106

Show and Tel System

An accessory from Omtel, Inc., allows any keypad telephone to serve as a transaction terminal, communication credit-card and other digital information, to and from a central computer.

The low-cost Omtel Show & Tel device is designed for locations where error-prone voice communications have been used for transmitting digital data.

For details contact Omtel, Inc., 27762 Forbes Rd., #14, Laguna Niguel, CA 92667.

CIRCLE INQUIRY NO. 395

Operator-Oriented Video Displays

Dasher D100 and D200 are designed to be used in a wide range of applications requiring high-speed, interactive communications combined with maximum operator efficiency.

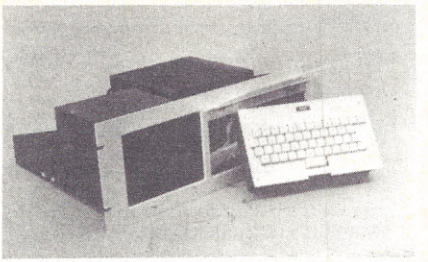
The terminals can be used with the full range of Data General computers. They can display up to 1,920 alphanumeric characters arranged in 24-line, 80-character format. All 96 upper and lower case ASCII characters can be displayed and are formed by a 7x11 dot matrix.

For details contact Data General, Route 9, Westboro, MA 01581.

CIRCLE INQUIRY NO. 396

Rack-Mountable Terminal

Informer, Inc. manufacturers a 19" rack mount computer terminal which requires only 7" of panel space. The R301 comes complete with a 6" diagonal display monitor, full alphanumeric keyboard, logic and power supply. 512 and 1024 character displays are available.



The unit is simple to interface having full/half duplex, RS232/20 ma loop, and selectable transmission rates from 110 to 9600 baud. The standard display is 32 columns by 16 lines.

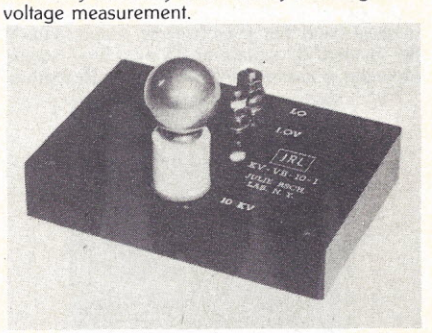
For details contact Informer, Inc., 8332 Osage Ave., Los Angeles, CA 90045, (213) 649-2030, W.R. Little, VP Marketing.

CIRCLE INQUIRY NO. 397

TEST EQUIPMENT

High Voltage Divider Network

The KV-VB-10 High Voltage Divider Network makes it possible to incorporate standards — laboratory accuracy and stability into high DC voltage measurement.



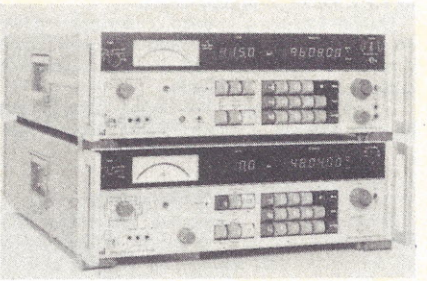
The rigid control of the high precision wire-wound resistor network, encapsulated with silicone resin in a diallyl phlalate housing, make it virtually immune to adverse atmospheric conditions.

For details contact Julie Research Laboratories Inc., 211 W. 61 St., New York, NY 10023.

CIRCLE INQUIRY NO. 296

S.L.M.S. from Marconi

The Selective Level Measuring Set consists of two units, a Level Oscillator, TF2356 (Sender) and a Selective Level Meter, TF2357 (Receiver). The two units form a 20MHz SLMS suitable for applications where the generation and measurement of signals to high accuracy is required.



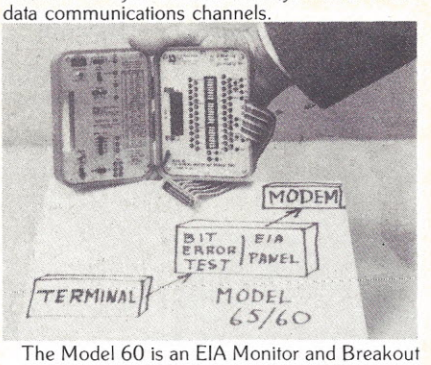
Analog and digital operation techniques are blended to provide speed, versatility and ease of use, made possible by microprocessor control and built-in synthesizers.

For details contact Marconi Instruments, 100 Stonehurst Ct., Northvale, NJ 07647.

CIRCLE INQUIRY NO. 290

Bit Error Rate Tester/Breakout Panel

The IDS Model 65/60 is composed of two units. Model 65 is a complete miniaturized modem test set capable of performing bit error rate tests on synchronous and asynchronous EIA data communications channels.



The Model 60 is an EIA Monitor and Breakout Panel. Together they provide a hand-held, battery powered unit for testing and monitoring data communications systems.

For details contact International Data Sciences, Inc., 7 Wellington Rd., Lincoln, RI 02856.

CIRCLE INQUIRY NO. 291

EPROM Tester/Duplicator

OAE has a production duplicator which combines both EPROM testing and programming in one unit. The UPP-2700 incorporates a unique circuit which evaluates all EPROMs both before and after programming.

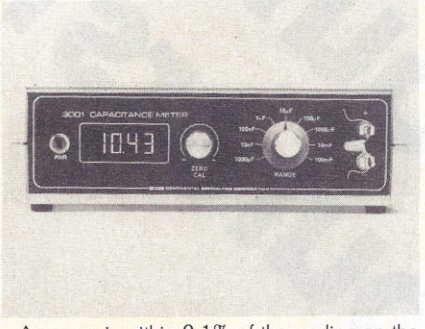
This circuit is designed to detect poorly erased or static damaged EPROMs which might otherwise pass a verify test.

For more information contact Oliver Advanced Engineering, Inc., 676 W. Wilson Avenue, Glendale, CA 91203.

CIRCLE INQUIRY NO. 292

Capacitance Meter

The Model 3001 bench-style Digital Capacitance Meter can measure capacitances from 1 pF to .1999 Farad to 3½ digits in nine ranges, 1000 pF to 100 mF nominal readings.



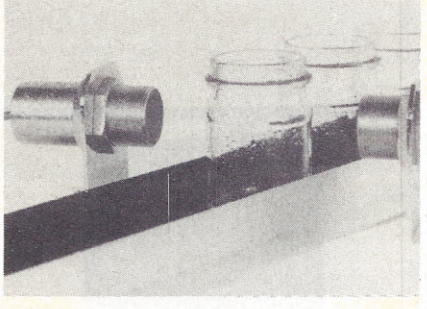
Accuracy is within 0.1% of the reading on the instrument's seven lowest ranges, and within ±0.5% of reading on the 10 mF and 100 mF ranges.

For more information contact Continental Specialties Corp., 70 Fulton Terrace, New Haven, CT 06509, (203) 624-3103.

CIRCLE INQUIRY NO. 293

Microsonic Sensor

Hyde Park's Microsonic sensing system is suited to sensing transparent materials such as glass, plastics and other products. The system is unaffected by messy inplant conditions and is immune to light, dust, water vapor, food particles



and other materials which may come in contact with the sensing face.

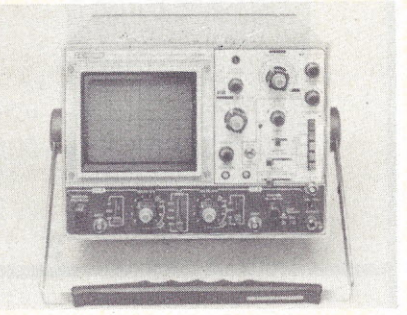
It accurately detects either metal or non-metal objects without the disadvantages of photoelectric sensors.

For more information contact Hyde Park Electronics, Inc., 4547 Gateway Cir., Dayton, OH 45440, Larry Tucker.

CIRCLE INQUIRY NO. 294

Delayed Sweep Oscilloscope

The Model 1530 30MHz scope offers 5 ranges of time base delay from 1us to 100 ms. The delayed-sweep capability is a major advantage in the evaluation of digital pulse trains and other



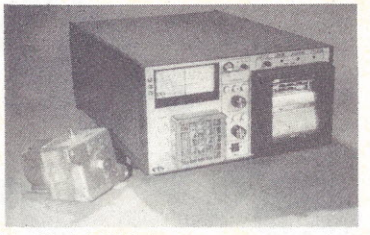
complex waveforms. In video applications, line and field information can be expanded and examined in detail.

For details contact B&K-Precision, 6460 W. Cortland St., Chicago, IL 60635.

CIRCLE INQUIRY NO. 400

Static Level Alarm System

A Static Level Alarm "ETS" System that continuously monitors electrostatic charge build-up levels at up to three remote locations at the same time has a response time of better than 10 milliseconds.



The Model 602 does not use any radioactive materials and uses audible and visual alarms. Monitoring sensors can be located up to 1000 feet from the main console.

Contact Analytical Chemical Laboratories, 2424 Pan Am Blvd., Elk Grove Village, IL 60007.

CIRCLE INQUIRY NO. 401

TOOLS

Miniature Precision Tool Kit

The JTK-24 miniature/subminiature tool kit contains more than 120 quality tools in a 10½ x 12½" multi-pocketed padded zipper case.

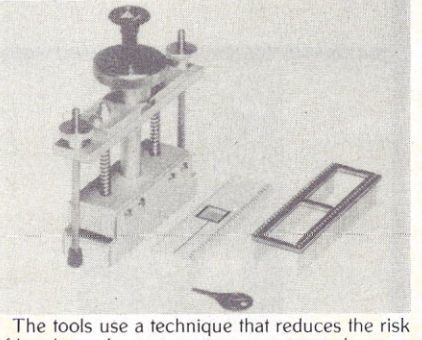
Included in the kit are screwdrivers, nutdrivers, pliers, wrenches, spline and hex keys, needle files, precision drills, optical aids and more.

For details contact Jensen Tools Inc., 1230 S. Priest Dr., Tempe, AZ 85281, (602) 968-6231.

CIRCLE INQUIRY NO. 297

DIP Insertion/Extraction Tools

The SERT-A-DIP and LIFT-A-DIP tools are for the insertion and extraction of large VLSI DIP packages, 64 pin on 0.9" centers.



The tools use a technique that reduces the risk of breakage due to insertion pressure and extraction force.

For details contact Micro Electronic Systems Inc., 159 Main St., Danbury, CT 06810.

CIRCLE INQUIRY NO. 298

6800 PRODUCTS at A-VIDD

Software Dynamics Compiler Basic

The SD Compiler Basic is the most well developed basic for the 6800. Some of the more noteable features include:

- Formatted Print Statements (Print Using 20)
- If Then Else & While Do
- Compiled Program is Rom-able
- Variable Names Up To 15 Characters
- 9 Digit Decimal Floating Point
- Dates, Times, Debug and Find
- Line numbers only where needed to be accessed by a Gosub, Goto, etc.
- High Speed Execution

Both random and sequential device I/O can be done in either binary or ASCII mode for data flow control to the byte. Disk files can be positioned to the byte for direct access. Now available for FLEX II, FLEX I, MINIFLEX and SSB FLEX II. Package includes: Basic compiler, Mal assembler (with extensive manuals for each), run time package, 4 misc. utilities and a data base manager program. Call or write for detailed catalog. Dealer inquiries invited.

Price $330.00
Software Dynamics Editor $100.00

SPL/M for FLEX II

Small Programming Language for MicroProcessors

SPL/M is a block-structured language which features arbitrary length identifiers and structured programming constructs. It is suitable for systems programming on small computers, since the compiler requires only 20K of memory and a disk system. SPL/M is a pure code compiler and is currently available for the SWPTC 6800 system using the FLEX II disk operating system. We will be releasing, in a short time, SPL/M for Smoke Signal's new D0568.50. Package consists of: 3 SPL/M Library files which allow both terminal and file I/O. All Major DOS routines are supported.

Price FLEX or SSB format $49.95

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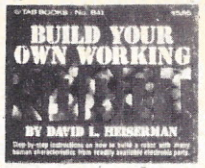
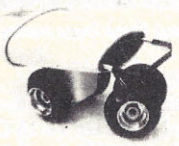
CIRCLE INQUIRY NO. 107

Puzzled About Computers?





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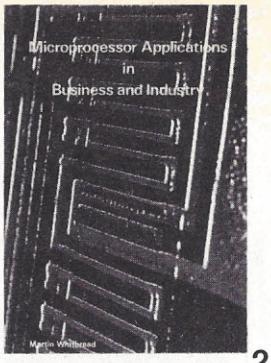

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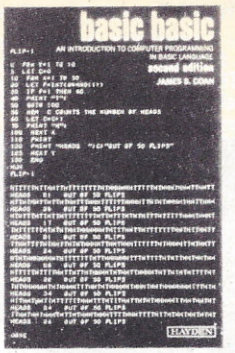

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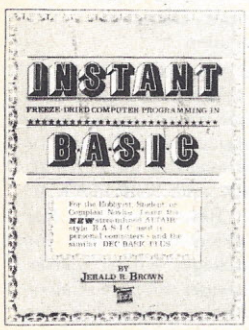

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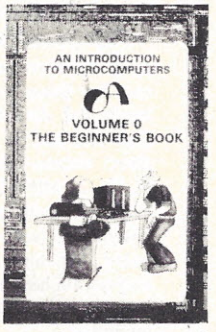

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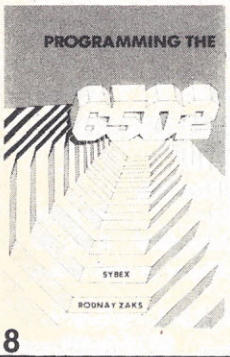

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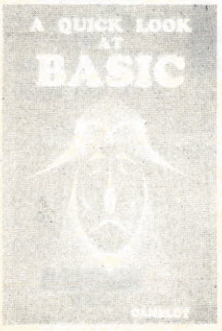

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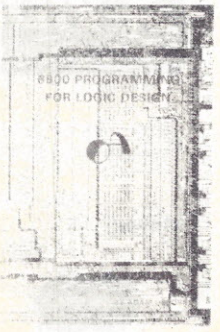

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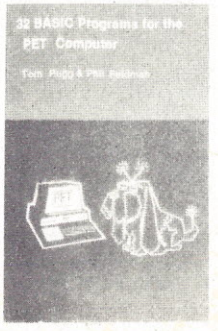

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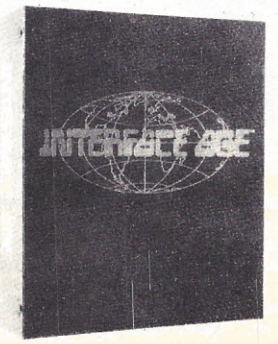

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MACRO-80
Microsoft's 8080/Z-80 Macro Assembler

Review by Alan R. Miller, Software Editor

INTRODUCTION

Assemblers, like BASIC interpreters, are available in various levels of complexity. The smallest ones have only a minimum of features and are not disk oriented. The larger assemblers incorporate most of the features found on large, mainframe computers. The Digital Research assembler, called MAC, falls into the latter category (see review in the December, 1978, INTERFACE AGE).

The Microsoft assembler also has a wealth of features. It runs on either an 8080 or Z-80 and can assemble code written with either the Intel 8080 or the Zilog Z-80 mnemonics. Actually, two separate programs are needed to produce the final binary image in memory: the assembler M80, and the linking loader L80.

Versions are available for the CP/M, DTC microfile, Altair DOS, and ISIS-II operating systems. The CP/M version 3.31 was used for the present review. An earlier version of MACRO-80 was briefly mentioned in a review of FORTRAN that appeared in the March 1979 issue of INTERFACE AGE.

DISK OPERATION

One of the advantages of a disk-oriented assembler like MACRO-80 is that it can assemble a very large source program. This is possible since the source program is never loaded into the computer main memory. The assembler reads the source program from disk. It then places the resulting assembly listing and the HEX-encoded binary files onto the disk.

Generally, only the symbol table and macros are placed in memory. With this arrangement, it is possible to assemble a source program that might occupy over 100 kilobytes of disk space. This size is larger than the usual 64 kilobyte memory size of the 8080 or Z-80.

Assembly language programs are generally written for stand-alone operation. However, MACRO-80 can also operate with programs generated by the Microsoft versions of FORTRAN, COBOL, and the compiling version of BASIC.

START WITH THE EDITOR

An assembly language source program is first written with the system editor. The default extension for the filename is MAC. The format for source lines is similar to that used by the Intel-compatible assemblers such as the Digital Research MAC.

Either lower case or upper case letters may be used. The Microsoft assembler, however, will not convert lower case letters to upper case. Each line of source code can have up to five elements:

```
LINE#  LABEL:  OPERATOR  ARGUMENTS  :COMMENTS
```

The line number is optional. If it is present, each digit of the number must have the high-order bit set to one. Microsoft's editor EDIT-80 (reviewed in July, 1979) and the editor on the DEC mainframe computers can generate this style of line number. However, the other CP/M system editors cannot produce the required form for the numbers. Furthermore, system operations such as TYPE, will not recognize the line numbers. As a consequence, these numbers will be printed as periods. If EDIT-80 is not available, it is better to omit the line numbers.

The remainder of each source line is free formatted. The label, if present, follows the line number, or is first if there is no line number. The label must end with a colon. This is a major source of incompatibility with fixed-format assemblers and the Digital Research assembler since these latter do not require the colon.

The operation code mnemonics (or op codes for short) are those used by Intel when the assembler is in the 8080 mode. When the Z-80 mode is invoked, the straight Z-80 mnemonic set specified by Zilog is invoked.* This latter set can be a source of trouble for those unfamiliar with the Zilog set.

While there is only one standard set of 8080 op codes, there are several variations in use for the Z-80. The Xitan assembler uses 8080-like mnemonics such as LSPD for load stack pointer direct, while Zilog uses the mnemonic LD SP,(NN). The Digital Research macro assembler generates the Z-80 op codes through a macro library. The mnemonics for some of the instructions give rise to yet another variation.

There is another peculiarity with the Z-80 assemblers. Zilog has chosen a consistent set of mnemonics for both the 8-bit and the 16-bit arithmetic operations.

```
ADD     A,C       ;ADD C TO A
ADD     HL,BC     ;ADD BC TO HL
```

Unfortunately, the scheme appears to be inconsistent when only the 8-bit operations are considered:

```
ADC     A,C       ;ADD C TO A & CARRY
ADD     A,C       ;ADD C TO A
SBC     A,C       ;SUBTR C & CARRY FROM A
SUB     C         ;SUBTRACT C FROM A
```

Notice that the last operand has only a single argument. For all four of these operations, the accumulator is the destination register. For that reason, some Z-80 assemblers allow the first operand to be omitted. A further complication is that several popular Z-80 programming books give different forms for these instructions.

SYMBOLS AND CONSTANTS

Symbols used in the source program can be any length, but only the first six characters are unique. The first character must not be a numeral. The characters may be:

A-Z 0-9 $. ? @ _

Numeric constants are 16-bit, unsigned numbers and so may range from zero to FFFF HEX. The default radix is decimal, but it may be changed with the RADIX pseudo op. A suffix applied to a number will override the default radix:

1101B	binary
7040	octal
723Q	decimal
99D	decimal
7FH	hexadecimal
X'FFFF'	hexadecimal

The second form for designating a HEX number is the same as used in FORTRAN.

String constants can be delimited by either paired apostrophes or by paired quotation marks:

```
DB      'This is a string'
DB      "John's code"
```

Apostrophes can be embedded in strings by use of quotation marks or by the use of two apostrophes together.

*Z-80-Assembly Language Programming Manual, Zilog, $7.50.

EXPRESSIONS

A complete set of operations is provided for generating expressions used as operands:

NUL
LOW, HIGH
* / MOD SHR SHL
unary minus
+ —
EQ NE LT LE GT GE
NOT
AND
OR, XOR

The above list is arranged in order of the hierarchy of evaluation. This order of precedence can be altered by the use of parentheses. The operations of LOW and HIGH take the low or high byte respectively of their arguments. SHR and SHL are respectively used to shift the argument right or left.

PSEUDO OPERATIONS

Pseudo operations, or pseudo ops for short, are assembler directives. Their form changes greatly from one assembler to the next. MACRO-80 provides an extensive set of pseudo ops with liberal features. For example, both the DB (define byte) and DW (define word) can take multiple arguments. Furthermore, both strings and numeric constants can be intermixed.

```
MESG:    DB    NDISK,"-disk version",0
```

(Some assemblers allow only one byte as the argument to DB and two bytes to DW. This makes the source code very long when there is a lot of ASCII text.)

The Z-80 mode is selected with the .Z80 pseudo op. For this part, the Zilog pseudo ops can be used. These include the DEFB for DB and the DEFW for DW.

Other pseudo ops are used to set the page length and to specify the page titles and subtitles. For FORTRAN compatibility, relative code should be generated starting at address zero, the default value. Code location can be set to any value with the ORG directive. Absolute code, used in conjunction with ORG, can be generated with the ASEG pseudo op.

CONDITIONAL ASSEMBLY

Several forms of a conditional pseudo op are provided so that different versions of code can be generated by a single source program:

```
IFxx        [ARGUMENT]
 • • •
 • • •
ELSE
 • • •
 • • •
ENDIF
```

The conditional tests include true, false, zero, not zero, argument defined, or not, and argument blank or not.

Pseudo ops are available for generating code in two locations. This might be necessary for programs that are to be placed in read-only memory (ROM).

Macros are used to define a prototype set of instructions that will vary from one invocation to the next. Arguments to the macro call at the point of invocation determine the actual form of the generated code.

As an example of macro use, consider a set of input routines for the console, the reader and the tape unit. Each of these routines will be similar, but will differ slightly. Thus a single subroutine cannot be used in this case. The desired code can be generated with macros as shown in Listing 1. The macro definition appears near the top of the source program. The ampersand symbol is a concatination operator.

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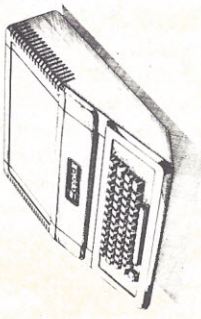

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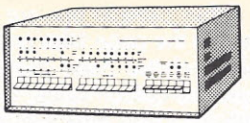

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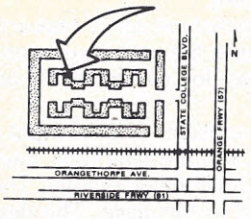

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LISTING 1

Three different input routines generated with macros.

```
0000            ASEG
                ORG     100H

0010            CSTAT   EQU     10H
0011            CDATA   EQU     CSTAT+1
0001            CIMSK   EQU     1
0012            RSTAT   EQU     12H
0013            RDATA   EQU     RSTAT+1
0001            RIMSK   EQU     1
0006            TSTAT   EQU     6
0007            TDATA   EQU     TSTAT+1
0040            TIMSK   EQU     40H

                INPUT   MACRO   X,Z
                LOOP&X:         IN      X&STAT  ;CHECK STATUS
                        ANI     X&IMSK  ;MASK FOR INPUT
                        JZ      LOOP&X  ;LOOP UNTIL READY
                        IN      X&DATA  ;GET THE DATA
                        ANI     7FH     ;MASK PARITY
                        RET
                        ENDM

                CONIN:  INPUT   C,Z     ;CONSOLE INPUT
0100 DB 10      LOOP&C:         IN      C&STAT  ;CHECK STATUS
0102 E6 01              ANI     C&IMSK  ;MASK FOR INPUT
0104 CA 0100            JZ      LOOP&C  ;LOOP UNTIL READY
0107 DB 11              IN      C&DATA  ;GET THE DATA
0109 E6 7F              ANI     7FH     ;MASK PARITY
010B C9                 RET
                RDRIN:  INPUT   R,Z     ;READER INPUT
010C DB 12      LOOP&R:         IN      R&STAT  ;CHECK STATUS
010E E6 01              ANI     R&IMSK  ;MASK FOR INPUT
0110 CA 010C            JZ      LOOP&R  ;LOOP UNTIL READY
0113 DB 13              IN      R&DATA  ;GET THE DATA
0115 E6 7F              ANI     7FH     ;MASK PARITY
0117 C9                 RET
                TAPEIN:         INPUT   T,NZ    ;TAPE INPUT
0118 DB 06      LOOP&T:         IN      T&STAT  ;CHECK STATUS
011A E6 40              ANI     T&IMSK  ;MASK FOR INPUT
011C C2 0118            JNZ     LOOP&T  ;LOOP UNTIL READY
011F DB 07              IN      T&DATA  ;GET THE DATA
0121 E6 7F              ANI     7FH     ;MASK PARITY
0123 C9                 RET

                        END
```

Each desired subroutine is obtained by a single call using the macro name and the proper argument:

```
CONIN:   INPUT   C,Z
RDRIN:   INPUT   R,Z
TAPEIN:  INPUT   T,NZ
```

Although macro assemblers usually remove the ampersand during expansion, Microsoft chose to leave the symbol in the assembly listing. The resultant code is, of course, correct. Notice that the second argument of the macro generates a JZ in the first and second subroutines, and a JNZ for the third.

ASSEMBLY

The ASCII source program is assembled with MACRO-80. There are several options available at assembly time. The most useful is perhaps:

B>A:M80 = source/L

where SOURCE is the name of the source file. This command generates a binary relocatable file of type REL. The L switch at the end also creates an ASCII assembly listing of type PRN. This file contains the resulting code and a symbol table. Additional switches can be used to set Z-80 mode, print the assembly listing with octal numbers, create an object file, and generate a cross reference file.

LOCATION IN MEMORY

There are several ways of setting the program location in memory. If program location is unimportant, then no ORG statement should be used. This would be the case when the assembly language program is to be linked to FORTRAN, COBOL, or the compiling BASIC. In this case, the assembler sets the program addresses relative to the zero.

Alternatively, the programmer may want the program loaded into a particular memory location. In that case, the two lines:

```
ASEG
ORG     <address>
```

should appear near the top of the program.

If the ultimate binary code is to reside above the operating system, a third option should be used. This would be the

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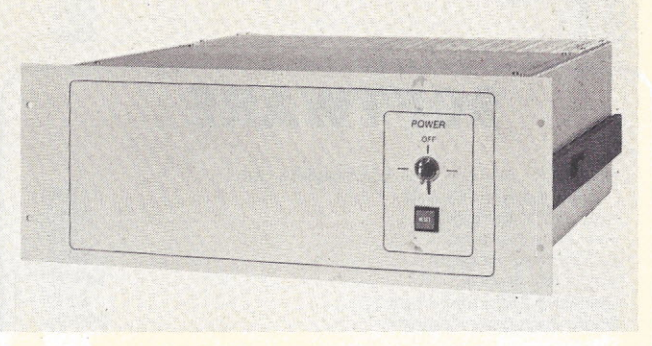

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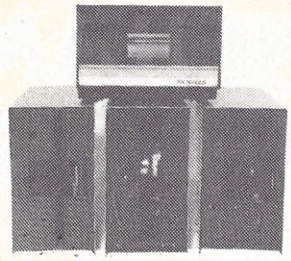

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case if a system monitor were to be developed for use in PROM. In this case the program location should be set with the statement:

```
.PHASE    <address>
```

Note that this directive starts with a decimal point.

EXECUTION

A binary relocatable file generated by MACRO-80 can be loaded and linked at run time with the linking loader L80. Programs compiled from FORTRAN, COBOL, and BASIC can also be linked at this time. Several switches are available to specify options. These are indicated with a slash symbol. The S switch will search libraries for needed modules rather than load the entire file. The N switch will save a copy of the resulting executable file.

A G switch can be given if the starting address has been defined with the END directive:

```
END       5800H
 • • •
A>L80  PROGRAM/G
```

This will cause the program to start up after it is loaded.

Alternatively, the E switch can be used:

```
A>L80  PROGRAM/E
```

In this case, L80 will load the program into memory, then exit to the system level. The memory address limits occupied by the program, and the decimal number of blocks needed to save the program are given. The user then types the SAVE command to save the executable file.

```
A>SAVE  15  PROGRAM.COM
```

If the .PHASE directive has been used to set the origin, then L80 loads the program into memory at the beginning of the user area. This is 100H for CP/M. The binary image can now be saved on disk with the SAVE command. But care must be taken in this case.

If the argument of the .PHASE directive was 0F000H, then the program will be assembled for this address. The added complication, however, is that a JMP 0F000H instruction has been placed at the head of the file. This jump instruction is now at the beginning of the file that was saved. The system debugger can be used to load the saved image. But this image must be loaded three bytes further down in memory to eliminate the extra jump.

An example of this load procedure is the following:

```
A>SID
#HF000  103          <get offset>
F103  EEFD           <sum and difference>
#IPROGRAM.COM
#REFFD               <load with offset>
#GF000               <jump to program>
```

The above sequence would be used if a monitor were assembled with the .PHASE 0F000H directive. The saved binary image would normally load at 100 HEX. But the first three bytes contain the jump to F000 HEX. The H command is used to find the load offset so that the JMP is eliminated. The I and R commands load the file, and the G command causes a branch to the program. If the program is to be loaded into read/write memory, prior to programming a PROM, then a different offset address would be used.

CONCLUSION

The Microsoft macro assembler MACRO-80 combines many useful features in an 18K byte package. The 8080 and Z-80 options mean that it can be used as a cross assembler. Z-80 code can be generated with an 8080 and vice versa. MACRO-80 is available by itself, but it is also included with Microsoft FORTRAN, COBOL, and the compiling BASIC.□

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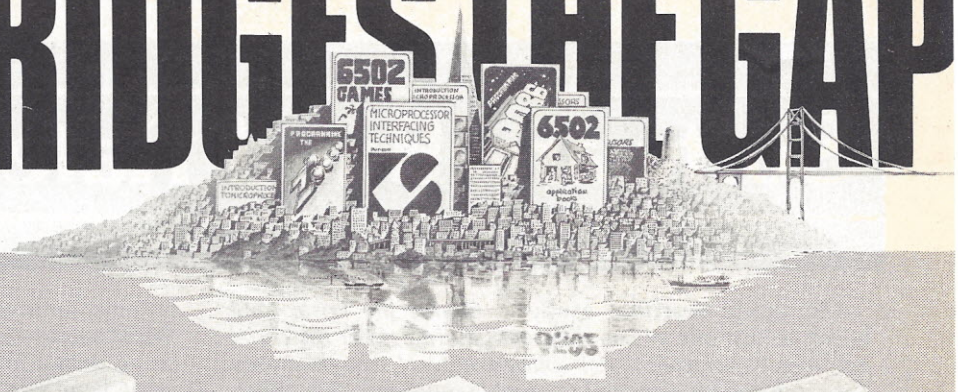

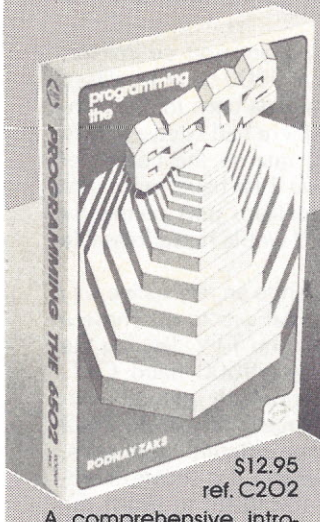

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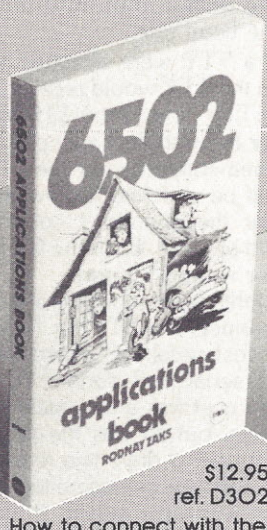

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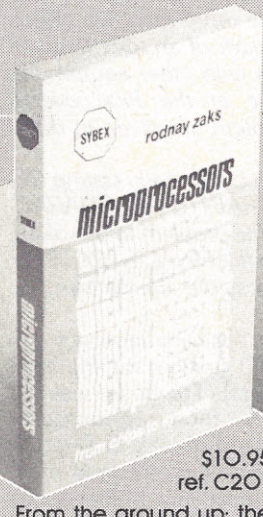

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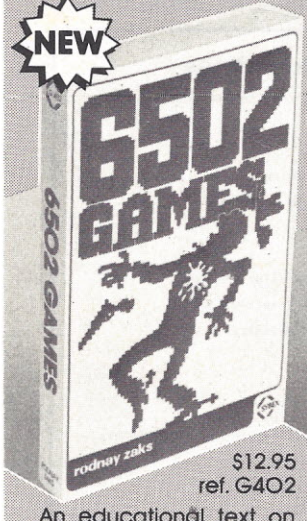

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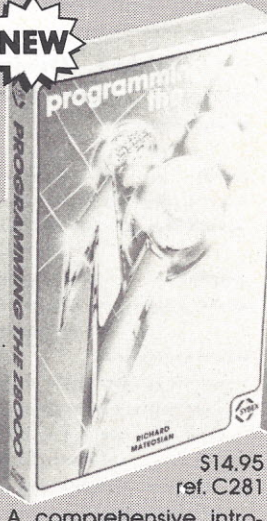

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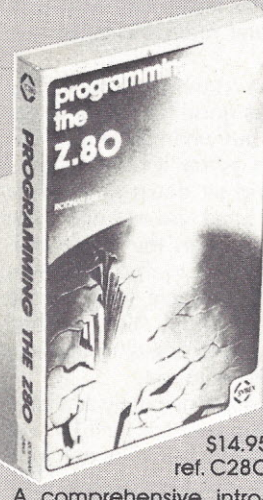

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Software Baud Rate Selection

By J. A. Goda

This article describes a way to modify the Imsai MIO board so that one of two different baud rates for the serial port may be selected under software control. The described approach can be extended to provide more than two selectable rates, and could provide the spark of an idea that will lead to the use of similar techniques with other equipment. The considerations used to arrive at the final overall approach to solving the design problem are given in detail in the article.

The practice of beginning a project by formally stating REQUIREMENTS, PURPOSE, CONSTRAINTS and CHARACTERISTICS identifies the elements of the problem to be solved. Then you are usually at a point where the FINAL STRATEGY can easily be selected from a few possible alternatives.

The system used for this article is basically an Imsai and uses an Imsai MIO board for all I/O (except for the front panel switches and lights — port 0FFH). The board was originally connected to a cassette recorder (now augmented by dual North Star disks) and to a 110 baud serial I/O Teletype terminal (TTY). A heavy software development load mandated that the low-speed TTY be replaced by a higher-speed CRT terminal.

A Soroc IQ 120 was selected and, since the TTY electrical interface levels were EIA standard, the only change needed to replace the TTY with the CRT was to move the jumpers on the MIO board to the positions that give 9600 baud operation. Then with the rotary switch on the back of the CRT set for 9600 baud, and the cable connected between CRT and MIO board, program development went into high gear. From that point on, programs were developed at a rapid rate — on the order of eight times faster than before, in terms of calendar time. A much greater reduction factor was experienced in 'hours spent.'

As we knew it would, the time soon came when hard copy output was needed. The fast CRT was good for first-time entry and executions of the programs, but when it came to debugging, long experience had shown us that it's best to get a listing (preferably double-spaced) and sit down someplace where you can comfortably use your head and a pencil. That way you can trace back and forth through the entire program, and annotate the listing as necessary to make changes or for better understanding. The 24 viewable lines on the CRT just aren't enough in such a situation. Also, we had plans to implement reporting and word-processing applications where hard copy was absolutely required.

The need for hard copy and a lack of immediately available funds prompted an appraisal of existing assets. The TTY was idle and available. It is a serial device. The MIO has only one serial input/output port. Sacrificing the high speed CRT capability in order to use this port for the TTY was out of the question, as was any thought of reconfiguring the hardware cables and jumpers each time a switch between CRT and TTY was needed.

A review of the Imsai MIO documentation confirmed that software baud rate switching was not available on the standard MIO board. An auxiliary port and connector was present on the CRT terminal. This connector simply acts as a feed-through path to/from the computer through the CRT terminal to/from a second terminal. If the computer sends 9600 baud serial data to the CRT, then that data is available as an output from the CRT auxiliary port connector at the same baud rate.

If a TTY were attached to the auxiliary port connector, then the TTY would receive the data at 9600 baud (useless). The TTY could send 110 baud serial data back to the computer through the same path. If only there had been a way to conveniently change the MIO baud rate so the computer could be switched to send and receive 110 baud serial data under the operator's control, the auxiliary port connector could be used. Both the CRT and TTY would be addressable at the same I/O port.

At this point, consideration was given to an alternative way to connect the TTY for hard copy. That was to purchase a low cost serial I/O board for use with the TTY, leaving the MIO serial port connected only to the 9600 baud CRT. Since cost was a consideration, this approach seemed unattractive, but so was the prospect of trying to use the MIO serial port to drive two terminals at two different baud rates.

A software consideration also emerged. If a second hardware port were added, it would be necessary to select the I/O port addressing as well as the baud rate in system I/O software. Existing applications software for our system was keyed to the use of only one I/O port. Although the system I/O routines could have been rewritten to accommodate both features, the benefits didn't warrant the additional instructions, no matter how few.

Thus from parts cost and software viewpoints, the best solution for us was to try to use the MIO serial port for both terminals by connecting the TTY to the CRT auxiliary port,

Table 1. Design Considerations

```
REQUIREMENT:      Connect 110 baud serial terminal to existing
computer system.

PURPOSE:          To obtain hard-copy as needed, while retaining
existing capability to display at 9600 baud on serial CRT
terminal when hard-copy isn't needed.

CONSTRAINTS:      1. Avoid having to modify existing applic-
ations software - any mods to be in system I/O software only.
                  2. Keep hardware cost and complexity as low as
possible. This means:
 - use the existing single SIO port.
 - avoid multiple-ganged switches.
 - avoid wires running from the MIO board to any external connections.
                  3. Make it simple to operate.
 - no jumpers, no need to remove cover from computer.
 - software controllable switching, if possible.
MIO CHARACTERISTICS: 1. jumper-selectable baud rates (+V or ground).
                     2. unused (latched) control bits are available.

FINAL STRATEGY:   1. Use control port bits to replace jumpers.
                  2. Use existing switch inputs(port 0FFH) for control.
                  3. Modify existing character I/O routines to read
port 0FFH prior to each character IN or OUT (to select a terminal)
and to write control bits for desired baud rate 'jumpering'.
```

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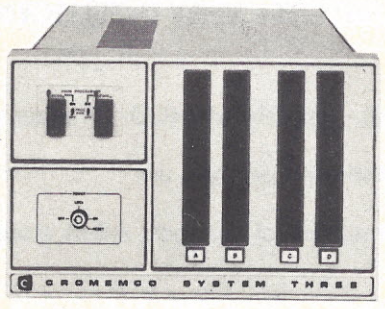

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and by changing the baud rate from 9600 to 110 with an external switch so as to avoid the need to modify existing software. All that remained after reaching this decision point was to find out how to implement the baud rate switching without using 12 pairs of wires and an expensive switch.

The Imsai manual showed us the connections needed to select any one of the baud rates (45.5, 75, 110, 134.5, 150, 300, 600, 1200, 2400, 4800, 9600) using 12 jumper wires. The jumpers needed for 9600 baud and for 110 baud are shown in Figure 1. The connections that remain the same for either baud rate are denoted by solid lines. Those connections that need to be changed are shown as broken lines.

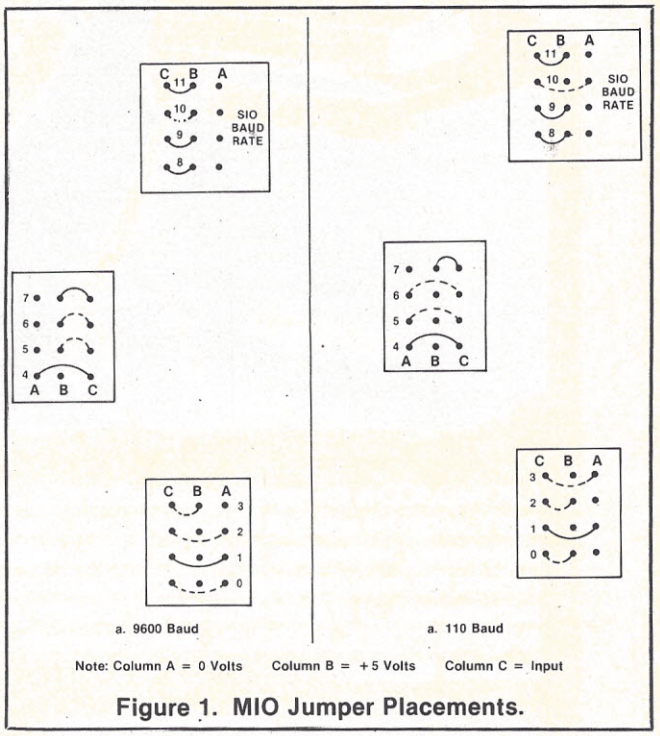

Figure 1. MIO Jumper Placements.

Figure 2a shows conceptually the electrical schematic that had to be implemented. When one 'gang' is high, the other is low and vice-versa. What at first seemed to be a complex switching requirement was boiled down to a simple implementation requiring only a double-pole/double-throw switch (or maybe a couple of gates).

Further examination of the Imsai documentation revealed that latched bits of the control port output were unused in our system. These bits can be set to 1 or 0 states simply by outputting selected bytes to the control port. Hence each bit of the control output behaves as a single-pole/double-throw

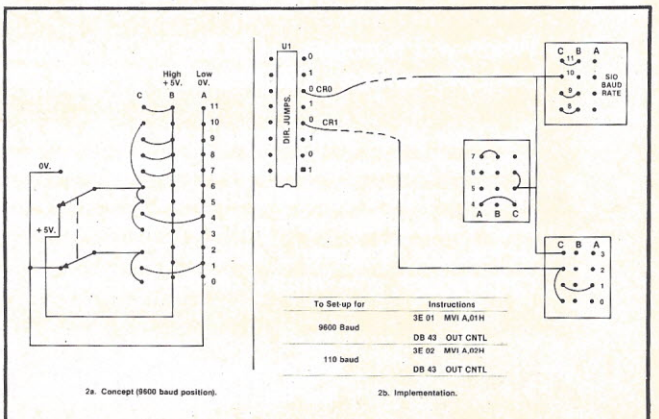

Figure 2. Switching Diagrams.

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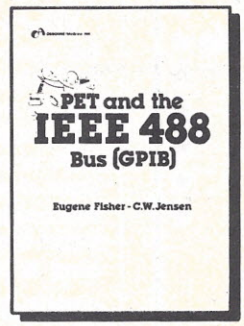

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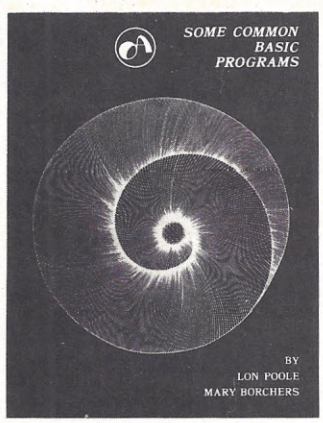

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switch, providing the needed high or low (Figure 2a) as output. Two control bits (CR0 and CR1) were chosen to be used in place of the switch in Figure 2a. Figure 2b shows literally the final wiring as it was mechanized.

What this means is that with a software OUT command to the control port, the baud rate could be selected as either 9600 (output a 01H) or 110 baud (output a 02H). The approach not only satisfied the original requirements but also was implemented completely on the MIO board. The 12 pairs of wires and the switch were avoided — no entanglement of wires comes off the board. The board can be plugged and unplugged to the bus. Only two wires were added to the board itself, and it wasn't necessary to purchase a switch, or even to scrounge one from a scrap box.

OPERATOR CONTROLS

All that remains to be described is the way the operator controls the software switching capability using the implemented hardware. Two choices were considered. For one, the operator could type a character (say CTL-P) that would signal the I/O routines to output the control character that sets up the 110 baud rate. The 110 rate would remain in effect until a second character (say CTL-N) was typed, then the 9600 baud would be set up.

Instead, a similar arrangement could be chosen, except the sense switches could be set by the operator and read by the program in place of the keyboard. The flowchart of Figure 3 illustrates both possibilities, with dashed lines enclosing the portions that were to be added to the existing I/O. The use of sense switches was the arbitrary selection we made.

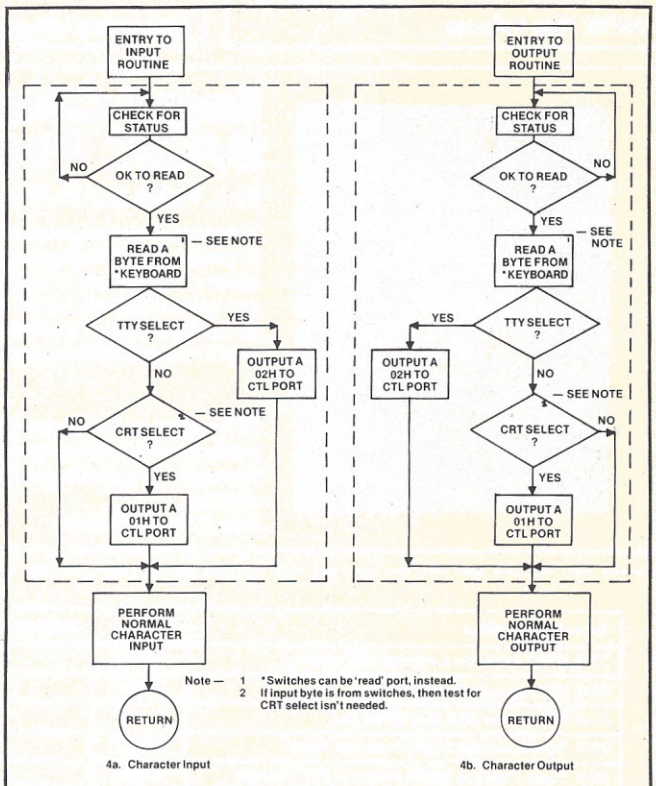

Figure 3. I/O Software Modifications.

No software initialization is needed when doing a bootstrap load. Sense switch #7 is normally in the 'up' position at load time, so the code (Program 1) was written to select 9600 baud when that switch is 'up.' The dashed lines in Program 1 enclose the 'new' code. The software 'looks' at sense switch #7 every time an I/O operation is performed. Thus the implementation is dynamic, meaning that either input or output can be instantaneously switched from one terminal to

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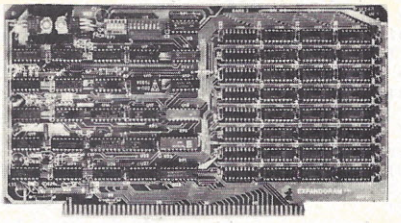

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The PROM-100 Programmer is a development tool for S-100 Bus computer systems. The Zero Insertion Force Programming Socket extends above the card cage height for easy access to PROM devices. Software verifies PROM erasure, verifies program loading and provides for reading of object file from Disk or PROM and programming into PROM/EPROM. Features include: On-board generated 25vdc Programming pulse, TTL compatible, maximum programming time for 16,389 bits is 100 seconds. Programs: 2708, Intel 2758, 2716, 2732 and TI 2516. DIP Selectable EPROM type.

PROM-100 Board Kit $149.95

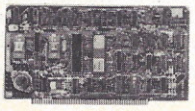
SD'S SBC-200 SINGLE BOARD COMPUTER Kit $289.95

S-100 Bus compatible and based on the powerful Z80 microprocessor, the SBC-200 meets the needs of a Z-80 CPU board with many additional features. Ideal for Industrial and control applications. All of the same features that have made the SBC-100 famous, PLUS 4MHz OPERATION. • S-100 Bus Compatible • Z80 Central Processing Unit • 1024 Bytes of Random Access Memory • 8K Bytes of PROM using 2716 • Serial Input/Output Port (with Asynchronous and Synchronous Operation) • Parallel Input and Output Ports • Four Channel Counter/Timer (Z80-CTC) • Software Programmable Baud Rate Generator • No-Front Panel Required for Operation • 4 MHz Operation.

SD'S VERSAFLOPPY II

• IBM 3740 Compatible Soft Sectored Format for Single Density Drives • Operates with Single and Dual Sided Drives, Single or Double Density Drives and 5" & 8" Drives — in any combination of four simultaneously • Drive Select and Side Select Circuitry • S-100 Bus Compatible • Vectored Interrupt Operation Optional • Phase Locked Loop Data Recovery Circuit • Operates with Z80 CPU's • Uses FD1791-1 Controller Chip • Ther Versafloppy II incorporates all the possible features of a flexible disk drive controller into one board. Capable of handling four drives simultaneously, combinations of any variety are possible, such as 5" single sided, 8" dual density dual sided, 5" dual density single sided. Most popular drives are controlled directly with the Versafloppy II. The operating system for the Versafloppy II is the extremely powerful SDOS available for SD Systems. Diagnostic and control software available to complete your disk system.

KIT $335.95



SD'S VDB-8024 VIDEO DISPLAY BOARD

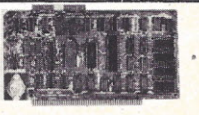
The VDB-8024 features its own on-board Z80 microprocessor. This gives the capability of using software (included in ROM) to control functions and enhancements without interference with the computer's CPU. Included in the special features: 80 characters by 24 lines display, keyboard power and interface, composite and separate video output, 2K on-board RAM, a total of 256 available characters, full cursor control, forward and reverse scrolling, underlining, field reverse, field protect enhancements, programmable characters.

KIT $329.95 A&T $389.95

SD'S "VERSAFLOPPY I" KIT

FEATURES: IBM 3740 soft sectored compatible, S-100 BNS Compatible for Z-80 or 8080. Controls up to 4 drives (single or double sided). Directly controls the following drives: Sugart SA400/450 Mini Floppy • Shugart SA800/850 Standard Floppy • PERSCI 70 and 277 • MFE 700/750 • CDC 9404/9406

$189.95



SD'S SBC-100 SINGLE BOARD COMPUTER

The SBC-100 provides a complete micro-computer on a single board! The Z80 microprocessor is used as the heart of the SBC-100. The SBC-100 meets all the requirements of a Z80 CPU board with the added features of I/O ports, counter/timer channels, on board RAM, provisions for PROM/ROM and a software programmable baud rate generator. S-100 Bus compatible, the SBC-100 features are: 8K bytes of available PROM, 1024 bytes on-board RAM, Serial I/O with both synchronous and asynchronous operation, Parallel I/O ports, Operational Vectored Interrupts, and Four Counter/Timer Channels. SD Monitor available for RS-232 and Video Terminals. Disk based system software also available.

SBC-100 KIT $249.95

TARBELL FLOPPY DISK INTERFACE

Compatible with Z80 & 8080. S-100 Bus. Uses CPM operating system. Plugs directly into your IMSAI or ALTAIR • Fastest transfer rate

KIT $190.00 Assembled & Tested $260.00

TARBELL CASSETTE INTERFACE

Plugs directly into your IMSAI or ALTAIR • Fastest transfer rate • Extremely reliable • Phase encoded • 4 extra status & control lines

KIT $99.95

CB2 Z-80 CPU

Board Kit $186.00

Operates at 2 MHZ or 4 MHZ by DIP switch selection and includes two sockets for 2716 or 2732 EPROMs or TMS 4016 2K RAMs. Jumper options generate the new IEEE S-100 signals.

VB3 80 Character Video Board Kit $299.95

• 80 char. per line, up to 51 lines • Graphics up to 160 × 204 matrix • Up to 256 user defined symbols (optional EPROM) • Composite video

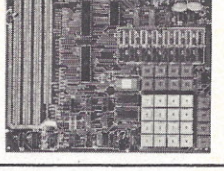
PB1 2708/2716 Programmer & 4K/8K EPROMBoard Kit $124.00

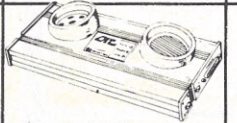
• S-100 bus • 2 separate programming sockets for 2708 or 2716 (5V) EPROMs • Programming voltage generated on board — no need for an external power supply • Software control of 2708/2716 programming selection • LED indicator for programming mode and an on-off switch for programming voltage • 4 sockets for 4K of 2708 or 8K of 2716 EPROMs • Unused EPROM sockets do not enable data bus drive so the board is never committed to the full 4K or 8K of memory • Jumper selectable wait states (0-4) for fast or slow EPROMS

Z80 STARTER KIT

Kit: $279.95 Assembled & Tested $349.95

SD System's Z80 Starter Kit enables the novice to build a complete microcomputer on a single board. Featuring the powerful Z80 microprocessor, the Z80 Starter Kit features • Keyboard and Display • Audio Interface • PROM Programmer • Expansion and Wire Wrap Area • On Board RAM • 4 Channel Counter/Timer • Z-BUG Monitor in PROM • I/O Ports.





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- 1K Bytes 2114 RAM
- 65K Memory Expansion
- User EPROM 2716

IO4 2 Parallel/2 Serial I/O Board Kit $126.00

• S-100 bus • 2 serial I/O ports (2 in & 2 out) • Independent baud-rate selection from 55 to 9600 baud • Regulated +5V, +12V & −12V outputs provided on both serial headers • 2 latched parallel I/O ports (2 in & 2 out) • Independent DIP switches for setting address • Interrupt capability provided for on serial and parallel I/O ports • +8V @ 0.95A, +16V @ 0.6A, & −16V @ 80mA typical

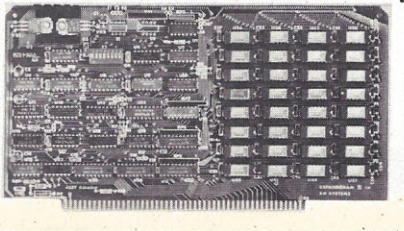
VB1B VIDEO BOARD KIT $124.00

• S-100 bus • 64 or 32 characters per line (DIP switch selectable), 16 lines • Graphics 128×48 matrix • Upper case, lower case, Greek characters, symbols and numbers • 7×9 dot character matrix • Black-on-white or white-on-black • Timing 60Hz vertical rate, 16.2KHz horizontal rate, Crystal 12.44MHz • Parallel and composite video output (US TV signals), separate video, horizontal and vertical sync

SD'S EXPANDORAM II
The Randem Access Memory

- S-100 Bus Compatible
- Up to 4Mhz Operation
- Expandable Memory from 16K to 256K
- DIP Switch Selectable Boundaries
- Uses 16K (4116) or 64K (4164) Memory Devices
- Page Mode Operation Allows up to 8 Memory Boards on Bus
- Operates with Z80 CPU's
- Phantom Output Disable
- Invisible Refresh (Synchronized with Wait States)

CIRCLE INQUIRY NO. 407



SD Systems' ExpandoRAM II is a dynamic RAM board with capacities from 16K bytes (4116) to 256K bytes (4164). It operates on the industry S-100 Bus. The design allows 8 boards to operate from the same S-100 Bus. The ExpandoRAM II is compatible with most S-100 CPU's based on the Z80 microprocessor.

EXPANDORAM II KIT

16K	$295.95
32K	369.95
48K	444.95
64K	519.95

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PROGRAM LISTING 1
I/O Software Modifications List

```
2900 DB 43          0100 H2900   IN    043H
2902 E6 02          0101         ANI   002H
2904 CC 2C 29       0102         CZ    H292C
2907 CA 00 29       0103         JZ    H2900
290A DB 42          0104         IN    042H
290C E6 7F          0105         ANI   07FH
290E C9             0106         RET
290F DB 43          0107 H290F   IN    043H
2911 E6 01          0108         ANI   001H
2913 CC 2C 29       0109         CZ    H292C
2916 CA 0F 29       0110         JZ    H290F
2919 78             0111         MOV   A,B
291A D3 42          0112         OUT   042H
291C C9             0113         RET
291D C9             0114         RET
291E DB 43          0115         IN    043H
2920 E6 02          0116         ANI   002H
2922 EE 02          0117         XRI   002H
2924 C0             0118         RNZ
2925 DB 42          0119         IN    042H
2927 E6 7F          0120         ANI   07FH
2929 FE 03          0121         CPI   003H
292B C9             0122         RET
292C 00             0123 H292C   NOP
292D DB FF          0124         IN    0FFH
292F E6 80          0125         ANI   080H
2931 CA 3B 29       0126         JZ    H293B
2934 3E 01          0127         MVI   A,001H
2936 D3 43          0128         OUT   043H
2938 C3 3F 29       0129         JMP   H293F
293B 3E 02          0130 H293B   MVI   A,002H
293D D3 43          0131         OUT   043H
293F 00             0132 H293F   NOP
2940 C9             0133         RET
2941 C9             0134         RET

SYMBOL TABLE

H2900 2900 H290F 290F H292C 292C H293B 293B H293F 293F
```

the other, even in the middle of a keyboard entry statement or during a print-out.

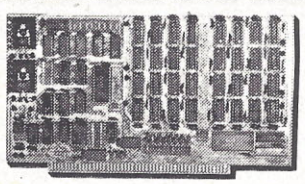
As it was implemented, the hard copy capability meets all of the original constraints. The hardware cost (we already had the TTY) turned out to be only a few cents worth of ordinary wire. The only feature missing that some might want is the ability to print simultaneously on the CRT screen and on the TTY paper. This can be accomplished by setting the rotary baud rate selector switch (on the back of the CRT cabinet) to the 110 baud position when you set sense switch #7 for hard copy. Otherwise, the 110 baud data 'passes through' the CRT terminal without being printed or recognized.

In practice, that is unnecessary. The print-out can be previewed on the CRT. This gives you a 'quick look' at the material to be printed on the TTY. Next, the CRT keyboard can be used to enter commands that get you again to the point where printing is ready to begin immediately after the next RETURN key entry. At this point, instead of pressing the RETURN key, sense switch #7 is set for 110 baud. (This effectively 'locks out' the CRT keyboard while the computer is waiting for the RETURN character.)

Next, you press the RETURN key on the TTY keyboard which allows the computer to begin sending the desired print-out at 110 baud. When the TTY stops printing, the sense switch is returned to the 9600 baud position and commands can again be entered from the CRT keyboard.

Although a great deal of description has been given for this project, it really took very little extra time to organize the approach in the manner described. Spending the extra time prevented us from going ahead with any 'false starts,' such as buying another serial interface board or an expensive switch.

If you use similar techniques in your own projects, I'm sure there will be many times when you will save that project's equivalent of '12 pairs of wires and an expensive switch'.□



64K BYTE EXPANDABLE RAM

DYNAMIC RAM WITH ON BOARD TRANSPARENT REFRESH GUARANTEED TO OPERATE IN NORTHSTAR, CROMEMCO, VECTOR GRAPHICS, SOL, AND OTHER 8080 OR Z-80 BASED S100 SYSTEMS ★ 4MHZ Z-80 WITH NO WAIT STATES.
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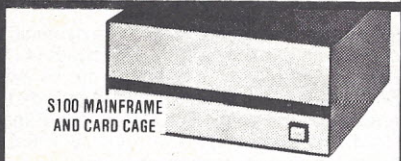
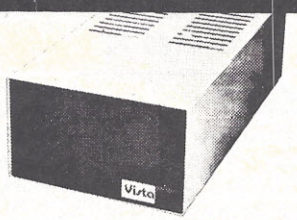
48K RAM	$529.00
32K RAM	$459.00
16K RAM	$389.00
WITHOUT RAM CHIPS	$319.00



- ★ W/ SOLID FRONT PANEL $239.00
- ★ W/ CUTOUTS FOR 2 MINI-FLOPPIES $239.00
- ★ 30 AMP POWER SUPPLY $119.00



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- ★ BUS BUFFERED WITH 1 LS TTL LOAD.
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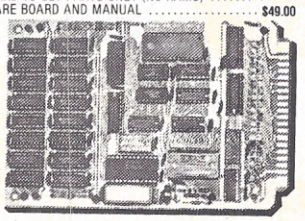
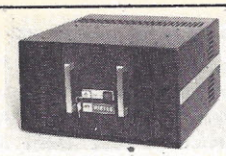
WITH 16K RAM	$349.00
WITHOUT RAM CHIPS	$279.00
HARD TO GET PARTS ONLY (NO RAMS)	$109.00
BARE BOARD AND MANUAL	$49.00





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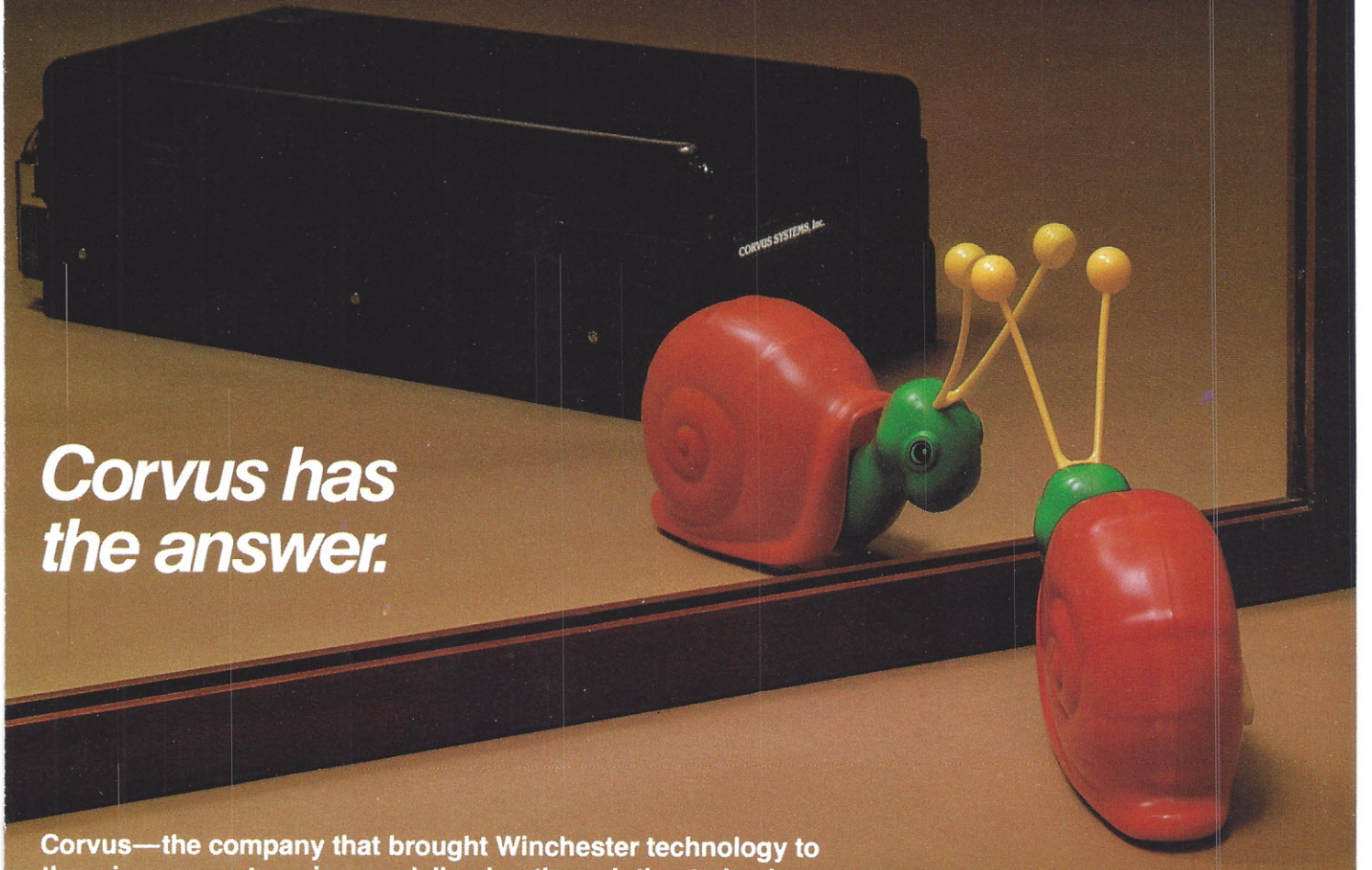

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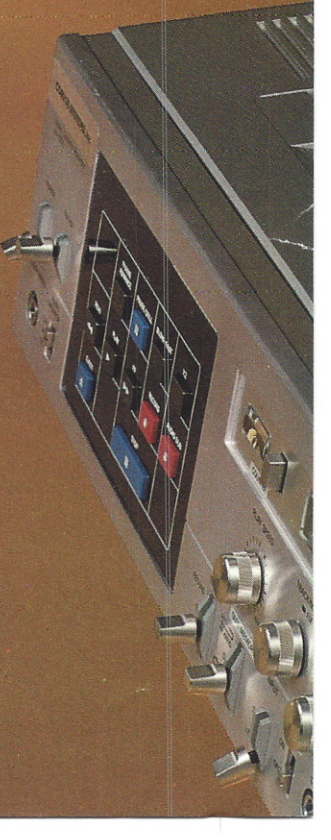

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